Smithville 3A Block Plan Area 9 Development

Transportation Impact Study

Final

September 25, 2025

Prepared for:
Lockbridge Development Inc.

Prepared by:
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Revision	Description	Author		Quality Check		Independent Review	
0A	Draft	C DEL ROSARIO, E CHEN	07/10	W YIP	07/11	J SZE	07/11
1	Draft	C DEL ROSARIO, E CHEN	08/15	W YIP	08/15		
2	Final	C DEL ROSARIO, E CHEN	08/16	W YIP	08/19	A MIRHOSEINI	08/19
3	Draft	C DEL ROSARIO, E CHEN	07/31	W YIP	08/25	M DAVIS	08/05
4	Final	C DEL ROSARIO, E CHEN	09/25	W YIP	09/25	M DAVIS	09/25

Sign-off Sheet

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1.0 INTRODUCTION

Stantec has been retained by Lockbridge Development Inc. (the "Developer") to conduct a Transportation Impact Study (TIS) for Block Plan Area 9, located in the southeast part of the community of Smithville, Township of West Lincoln (the "Town"), Niagara Region, Ontario.

Block Plan Area 9 is the development area associated with Stage 3A of the *Smithville Master Community Plan (MCP)*. The Block Plan Area 9 (the "Block") encompasses approximately 61.07 hectares of land southeast of the intersection of Townline Road (Regional Road 14, or RR14) and Port Davidson Road. The proposed development by the Developer is specific to Phase 1 of the Block and encompasses approximately 11.75 hectares of land in the northeast part of the Block.

According to the *Comprehensive Block and MESP Guidelines* of the Township of West Lincoln, a single TIS is to be completed for each Block irrespective of the number of landowners/developers for each Block. The purpose of this TIS is to assess the potential transportation impacts of the proposed development of the entire Block and assess the impacts of the proposed development specific to Phase 1 of the Block. The impacts on both the surrounding transportation network and site-specific transportation components were examined.

A TIS report was initially submitted in August 2024 based on an outdated site plan; comments were subsequently received from Niagara Region (the "Region"). The Region's comments, along with Stantec's responses, are summarized in **Appendix L**.

The assumptions and findings of this updated TIS are documented in this report, which consists of the following sections:

- **Section 1** introduces the report and provide information of the proposed development.
- **Section 2** discusses the existing transportation network (i.e. automobile, truck, pedestrian, transit, and cycling routes and infrastructure).
- **Section 3** provides information on the proposed development, future study area transportation network, and adjacent background developments.
- **Section 4** details the methodology and presents the results of trip generation, trip distribution, and trip assignment forecasts for the subject site and background developments.
- **Section 5** details the methodology used for traffic operations analysis, and presents results for existing condition, future background, and future total scenarios.
- **Section 6** outlines transportation demand management measures.

- **Section 7** details the methodology and presents the results for the site access sightline analysis.
- **Section 8** provides a summary of the study and offers recommendations based on the preceding sections.

1.1 STUDY AREA

The study area is shown in **Figure 1-1** and includes the following intersections:

1. Townline Road and Port Davidson Road (unsignalized);
2. Townline Road and Canborough Street (unsignalized);
3. Townline Road and Shurie Road (unsignalized);
4. Townline Road and Alma Drive (unsignalized);
5. Townline Road and St Catharines Street (roundabout); and,
6. St Catharines Street and Industrial Park Road (unsignalized).

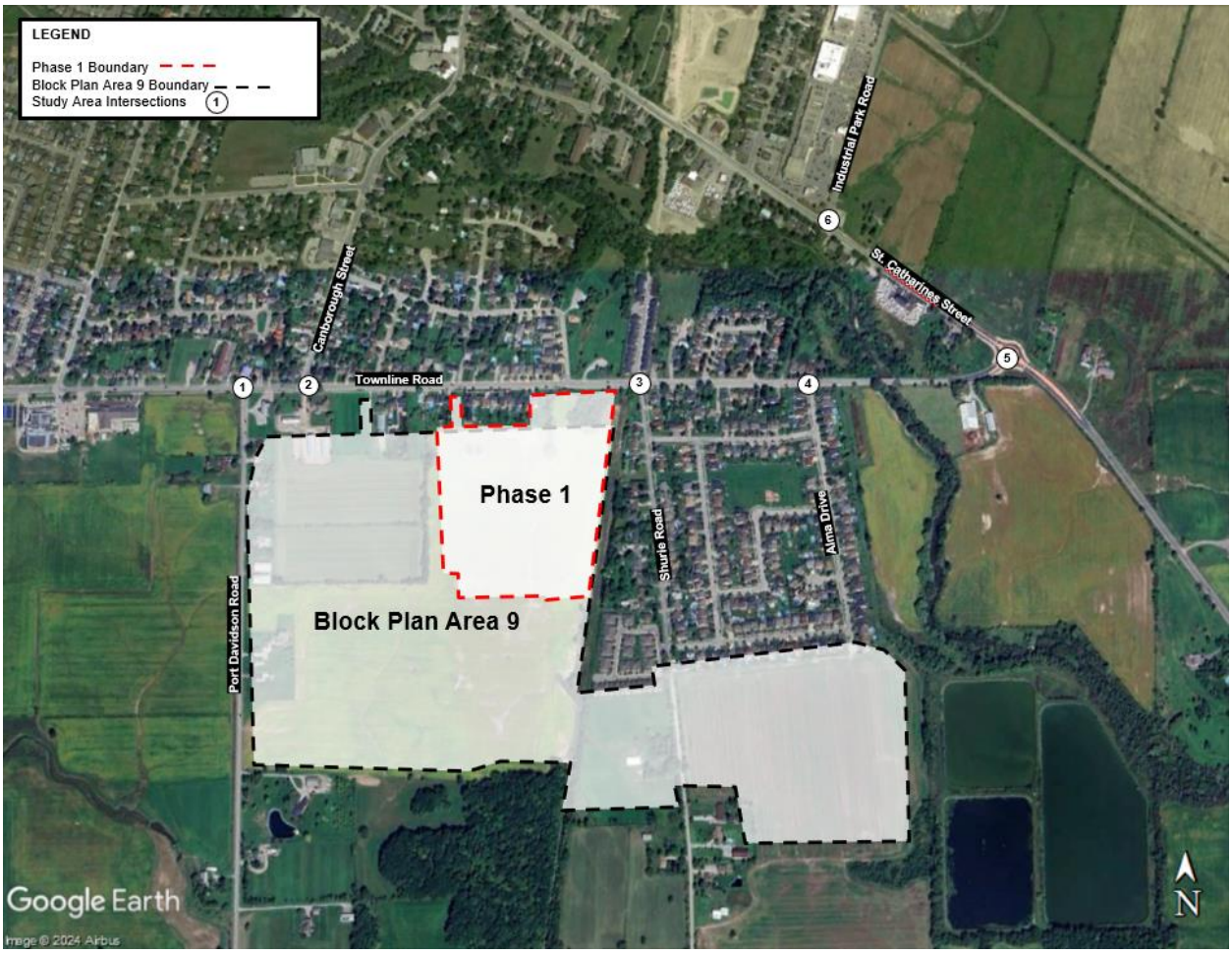


Figure 1-1: Proposed Site Location and Study Area Intersections

1.2 TRAFFIC COUNT DATA

Turning movement count (TMC) data were obtained from the Niagara Region for the intersection of St Catharines Street (Regional Road 20, or RR20) and Industrial Park Road. The TMCs for the remaining intersections were collected by Traffic Survey Analysis Inc. A summary of TMC data is found in **Table 1.1**. Detailed TMC data are available in **Appendix A**.

Table 1.1: Turning Movement Count Details

Intersection No.	Intersection	Date Collected	Source
1	Townline Rd (RR14) and Port Davidson Rd	13-Jun-24	Traffic Survey Analysis Inc.
2	Townline Rd (RR14) and Canborough St	13-Jun-24	Traffic Survey Analysis Inc.
3	Townline Rd and Shurie Rd	13-Jun-24	Traffic Survey Analysis Inc.
4	Townline Rd and Alma Dr	13-Jun-24	Traffic Survey Analysis Inc.
5	St Catharines St (RR20) and Industrial Park Dr	13-Jun-24	Traffic Survey Analysis Inc.
6	Townline Rd and St Catharines St (RR20)	15-Jun-23	Niagara Region

1.3 HORIZONS, SCENARIOS, AND GROWTH RATES

Considering the scale and specifications of the development, the following scenarios were evaluated in this study:

- Existing conditions in 2024;
- Future background traffic without Phase 1 development in 2030;
- Future total traffic with Phase 1 development in 2030.

The future horizon of 2030 represents five years after the expected construction year of 2025.

For all selected scenarios, traffic volumes during the weekday AM and PM peak hours were utilized for the analyses.

As per correspondence with the Niagara Region staff, provided in **Appendix B**, an annual growth rate of 3.0% was applied to the available and collected traffic count data to project traffic volumes for the existing year (2024) and the future horizon year (2030). This growth rate is relatively conservative as according to the Town's *Smithville Transportation Master Plan (2023)*, an annual growth rate of 2.5% is projected for internal-to-internal trips, and a linear annual growth rate of 2.0% is projected for all other trips to, from, or through Smithville.

2.0 EXISTING CONDITIONS

2.1 LAND USE

The proposed development site for Block Plan Area 9 is located at the southeast corner of the Townline Road (Regional Road 14) and Port Davidson Road intersection within the Township of West Lincoln.

Under the existing conditions, the subject site is mostly vacant. Several residential units currently occupy a small area north of the site, along Townline Road. These units will largely remain upon construction of the proposed development.

The subject site is surrounded by residential land uses as pictured in **Figure 2-1** below from the Town's Community Map.

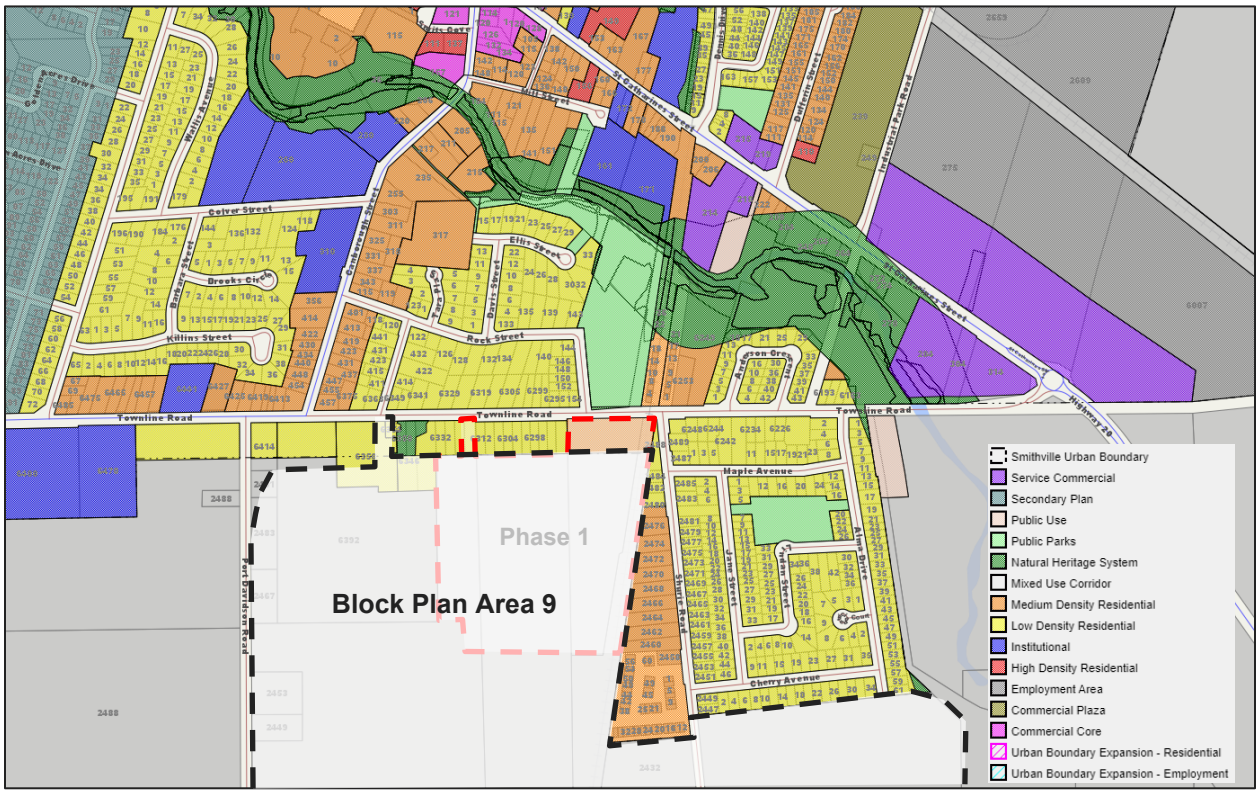


Figure 2-1: Existing Land Use (Source: *Township of West Lincoln Community Map*)

2.2 TRANSPORTATION NETWORK

Figure 2-2 below depicts the road classification of the road network surrounding the study area, as outlined in the Niagara Region's Map of Regional Roads.

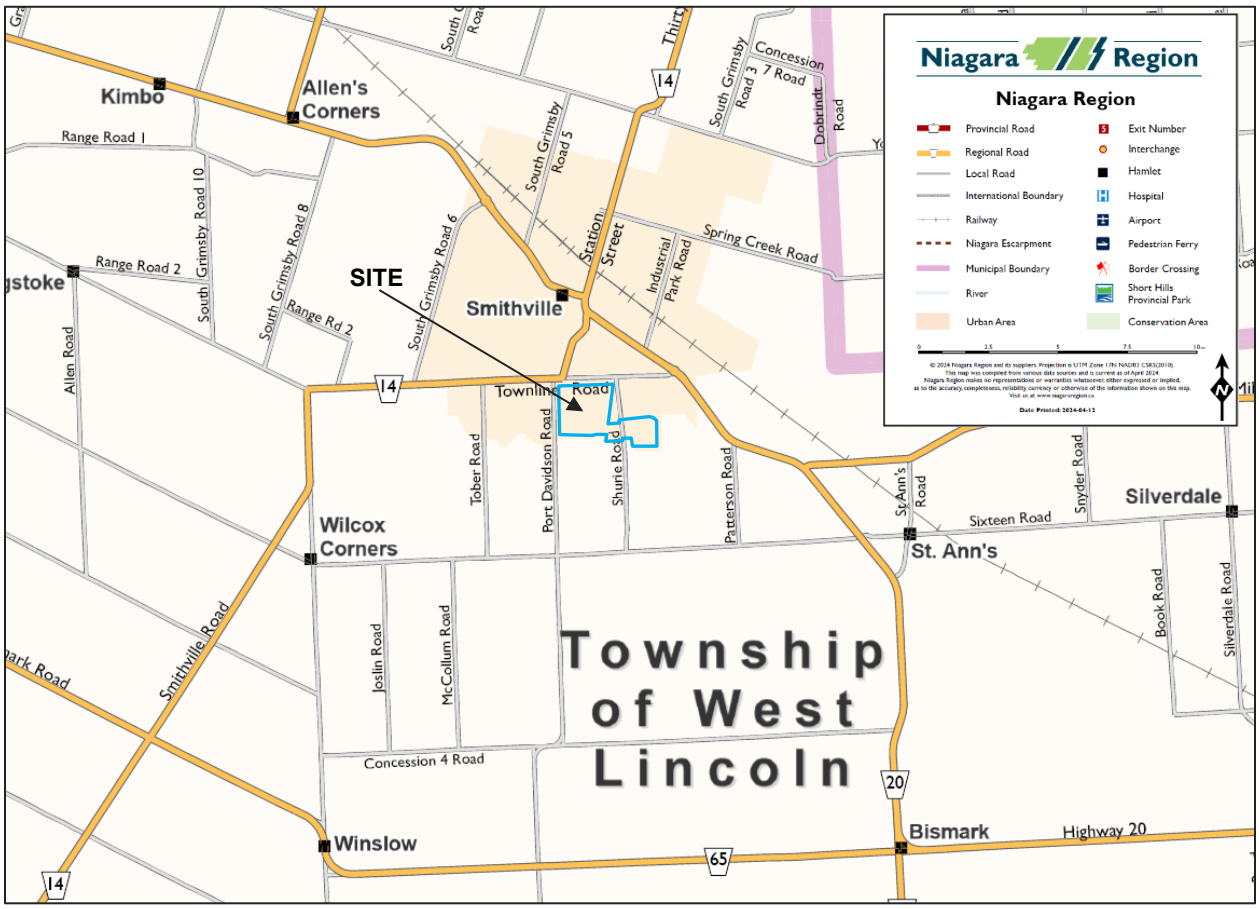


Figure 2-2: Study Area Road Classification (Source: *Niagara Region Map of Regional Roads*)

Townline Road is a two-lane east-west arterial road under the jurisdiction of the Niagara Region west of Canborough Street – known as Regional Road 14 – and a collector road under the jurisdiction of the Township of West Lincoln east of Canborough Street. Sidewalks are provided on both sides of the road. Through the study area, the posted speed limit is 50 km/h.

Port Davidson Road is a two-lane north-south township arterial road under the jurisdiction of the Township of West Lincoln. Sidewalks are not provided on either side of the road. Through the study area, the posted speed limit is 80 km/h.

Canborough Street is a two-lane north-south arterial road under the jurisdiction of the Niagara Region – known as Regional Road 14. Sidewalks are provided on both sides of the road. Through the study area, the posted speed limit is 50 km/h.

Sterling Street is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. No sidewalks provided on the east side of the road. Through the study area, the posted speed limit is 50 km/h.

Rock Street is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. No sidewalks provided on the east side of the road. Through the study area, the posted speed limit is 50 km/h.

Shurie Street is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. Sidewalks are provided on the east side of the road. Through the study area, the posted speed limit is 50 km/h.

Alma Drive is a two-lane north-south local road under the jurisdiction of the Township of West Lincoln. Sidewalks are provided on the west side of the road. Through the study area, the assumed speed limit is 50 km/h.

St Catharines Street is a two-lane north-south arterial road under the jurisdiction of the Niagara Region – known as Regional Road 20. No sidewalk is provided south of Townline Road roundabout, and sidewalk is only provided on the west side of roadway north of Townline Road roundabout. Through the study area, the posted speed limit north of Townline Road and in the road segment between the roundabout intersection and approximately 200 metres south of that intersection are 50 km/hr. Further south of this location, the posted speed limit becomes 80 km/hr.

Industrial Park Road is a two-lane east-west collector road under the jurisdiction of the Township of West Lincoln. Sidewalks are not provided on the either side of the road. Through the study area, the posted speed limit is 50 km/h.

The existing roadway lane configurations and intersection control types are illustrated in **Figure 2-3.**

2.2.1 Transit Service

Within the study area, there is currently no regularly scheduled transit service provided. However, the Niagara Region Transit (NRT) offers OnDemand service which enables riders to travel to and from the municipalities within the Region. It is of note that internal OnDemand trips within the Township of West Lincoln are currently not available.

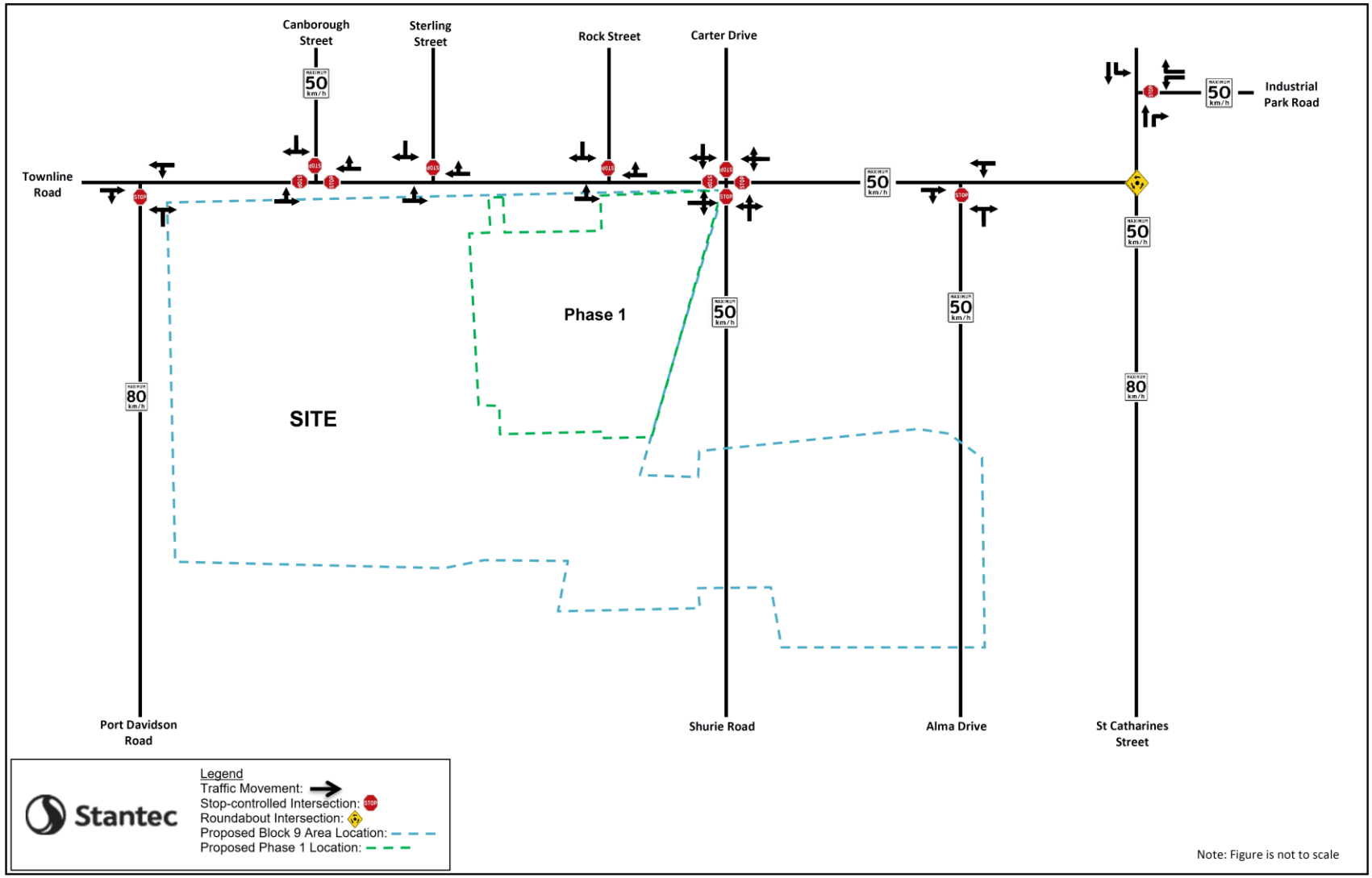


Figure 2-3: Existing Lane Configuration and Intersection Control

2.2.2 Active Transportation Network

According to the Town's *Smithville Transportation Master Plan (TMP)*, existing on-street cycling facilities within the study area are as follows:

- Along St Catharines Street (Regional Road 20) on both sides of the road between Dufferin Street and Townline Road.
- Along Canborough Street (Regional Road 14) on both sides of the road between Smits Cove and Townline Road.

These existing bike lanes are illustrated in **Figure 2-4.**

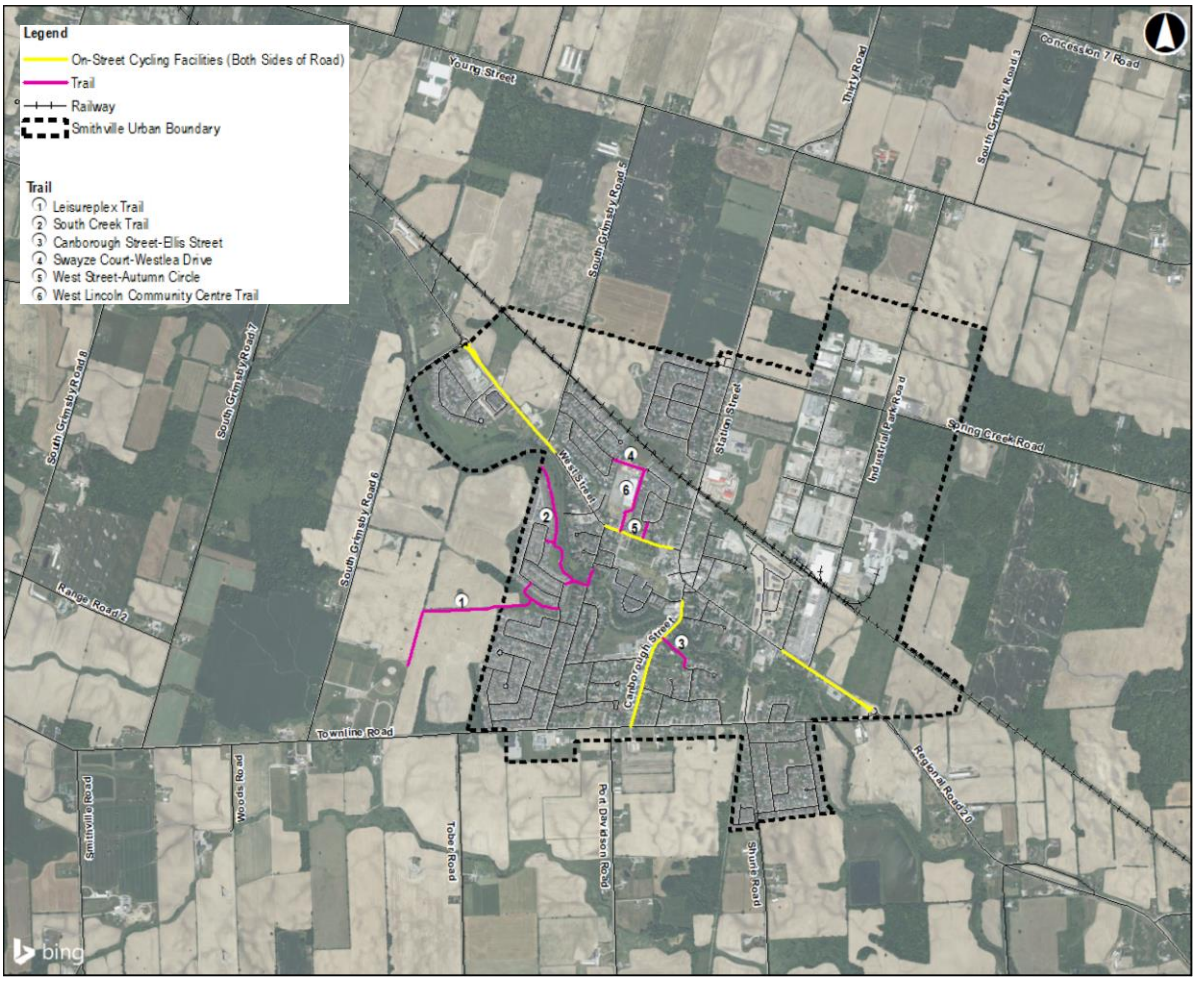


Figure 2-4: On-Street Cycling Facilities within the Study Area (Source: Smithville Transportation Master Plan, 2023)

3.0 PROPOSED DEVELOPMENT AND FUTURE NETWORK

3.1 PROPOSED DEVELOPMENT

The proposed Block development, known as Block Plan Area 9, is situated in the southeast quadrant of the intersection of Townline Road (Regional Road 14) and Port Davidson Road in Smithville. The Block development is part of Stage 3A in the development staging plan of the *Smithville Master Community Plan (MCP)* of the Township of West Lincoln.

In this TIS, the proposed developments in Block Plan Area 9 are divided into two components – Phase 1 development, and Block area development outside of Phase 1.

The land use concept plan of the Block development (May 2025) is illustrated in **Figure 3-1** with Phase 1 shown in the dashed cyan line. The Block area under the land use concept plan was assumed to comprise of 937 residential units – of which, 476 are low density residential units, and 461 are medium density residential units. The distribution between the number of low and medium density units was estimated based on the distribution of development areas by type.

The resulting Block area outside of Phase 1 under the land use concept plan is assumed to comprise of 782 residential units – the difference between the total Block area estimate and the Phase 1 estimate.

The land use distribution information under the concept plan is summarized in **Table 3.1**.

Furthermore, a detailed draft plan of the Phase 1 development (May 2025) is illustrated in **Figure 3-2**.

Phase 1 development under the detailed draft plan is comprised of 222 residential units – of which, 177 are single detached units, 14 are semi-detached units, and 31 are townhouse units.

With the information provided in the detailed draft plan of Phase 1 development (increase from 155 to 222 residential units), the total Block Plan Area 9 development is revised to 1,004 residential units (222 residential units in Phase 1, plus 782 residential units in Block area outside of Phase 1), with the land use distribution correspondingly adjusted to incorporate the more detailed information provided in the draft plan. This revised land use distribution is summarized in **Table 3.2**.

Table 3.1: Land Use Distribution according to Concept Plan

Land Use	Area (ha)	Area Distribution	# Units
Phase 1 Development (Concept Plan, May 2025)			
Low Density Residential			130
Medium Density Residential			25
TOTAL			**155**
Block Plan Area 9 Development (Concept Plan, May 2025)			
Low Density Residential		66%	476
Medium Density Residential		34%	461
TOTAL		**100%**	**937**
Block Plan Area 9 Development, minus Phase 1 (Concept Plan, May 2025)			
TOTAL			**782**

Table 3.2: Revised Land Use Distribution using Draft Plan Statistics

Land Use	Area (ha)	Area Distribution	# Units
Phase 1 Development (Draft Plan, May 2025)			
Single Detached Dwellings			177
Semi Detached Dwellings			14
Townhouse Dwellings			31
TOTAL			**222**
Block Plan Area 9 Development, minus Phase 1 (Draft Plan, May 2025)			
Low Density Residential		61%	479
Medium Density Residential		39%	303
TOTAL		**100%**	**782**
Updated Block Plan Area 9 Development			
TOTAL			**1004**

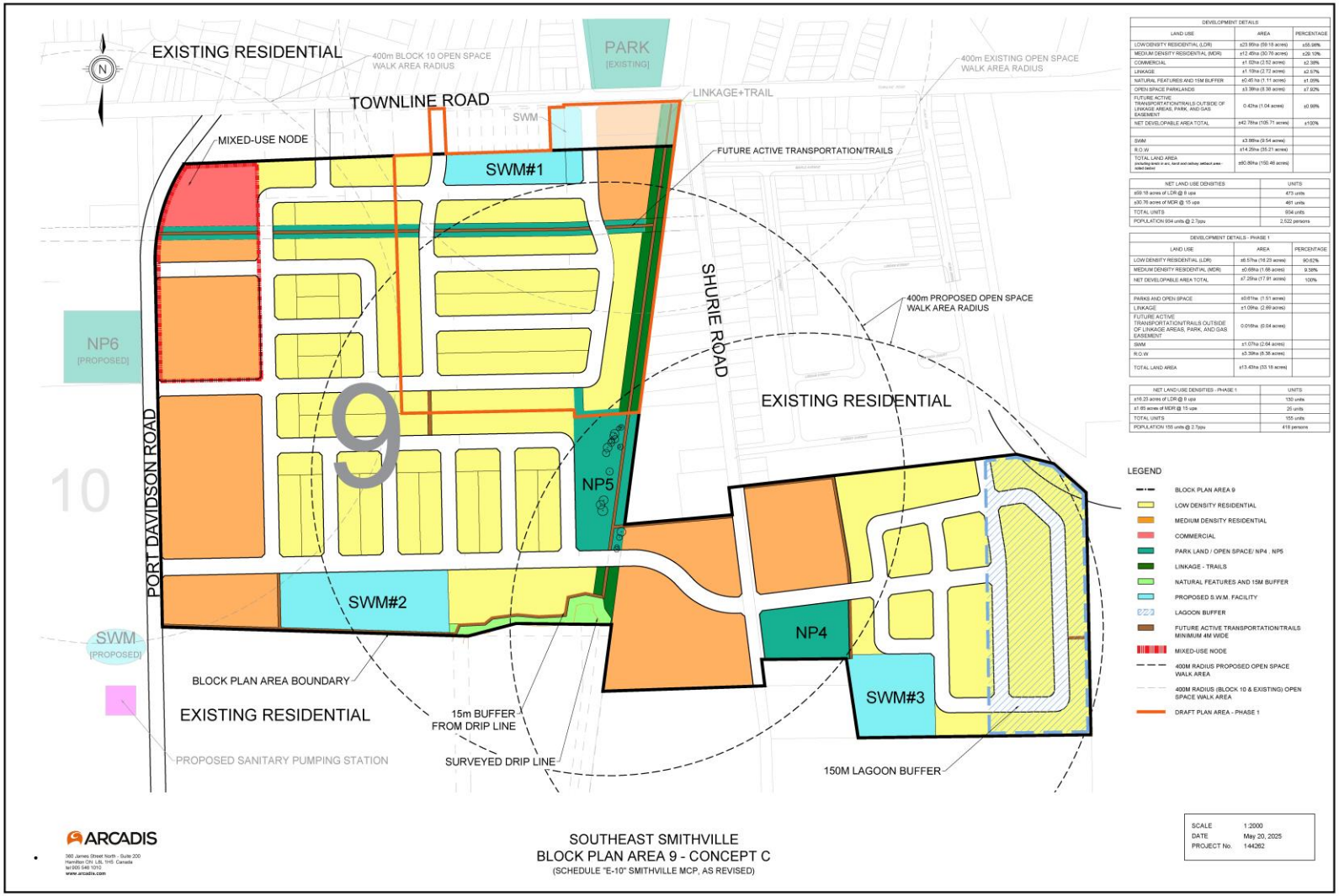


Figure 3-1: Block Plan Area 9 Land Use Concept Plan (Arcadis, May 2025)

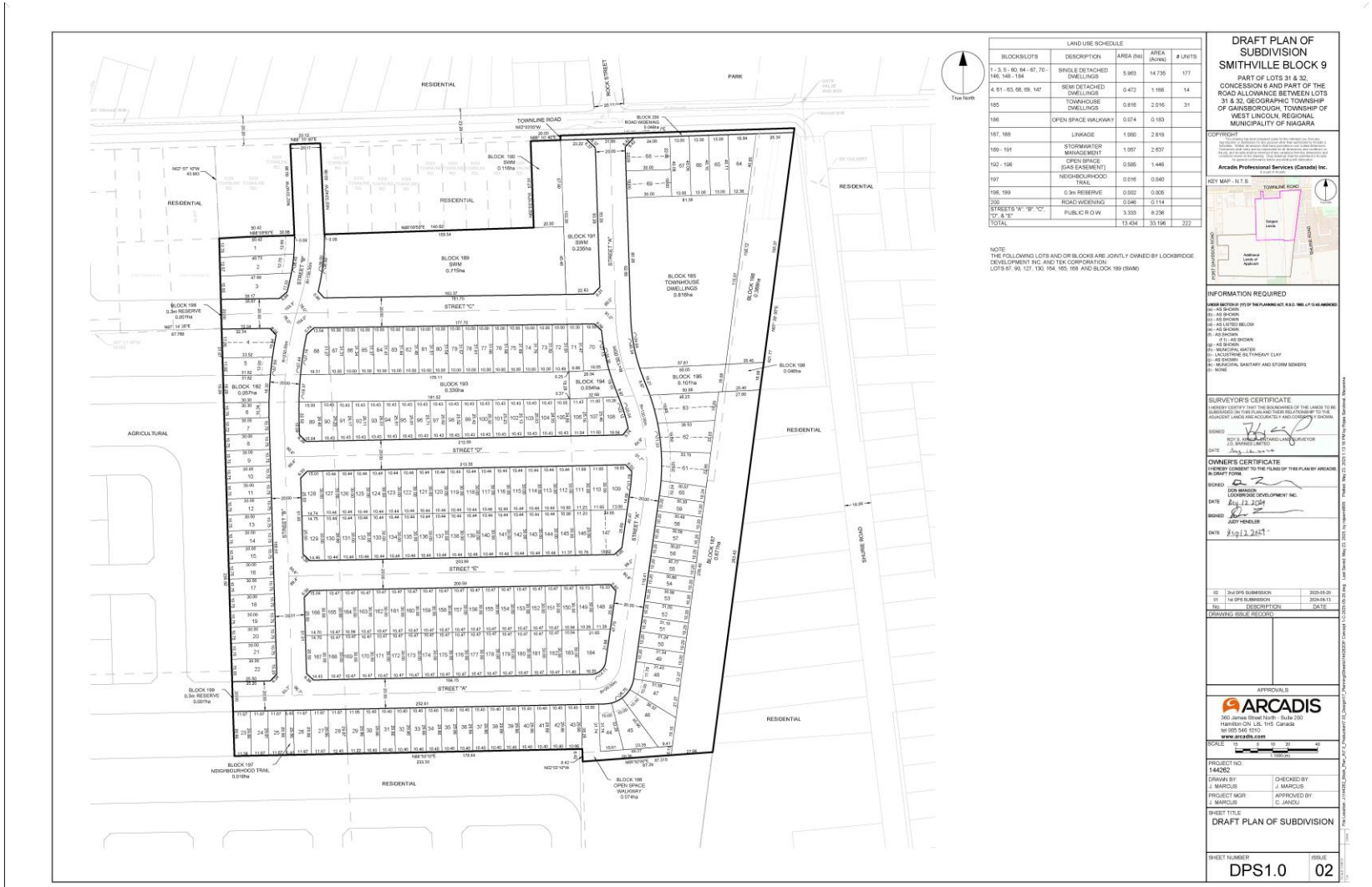


Figure 3-2: Proposed Draft Plan of Phase 1 Development (Arcadis, May 2025)

3.2 FUTURE TRANSPORTATION NETWORK

The existing conditions transportation network in the study area outside of Block Plan Area 9 is detailed in **Section 2.2**.

The study area road network at the future horizon year (2030) is expected to be equivalent to the existing conditions road network.

Per the Town's *Official Plan Amendment (OPA) No. 63, Schedule 'L'*, and the *Smithville TMP*, the Township proposed a future realignment of Port Davidson Road to align with Canborough Street in its intersection with Townline Road to support development of the Urban Boundary Expansion Lands. According to Table E-3 of the *Smithville TMP*, the realignment is planned to be implemented in the next 10 to 20 year timeframe.

Since this planning horizon for the realignment is beyond the future horizon year of the development (2030), the existing intersection configurations at Port Davidson Road and Townline Road and at Townline Road and Canborough Street have been maintained for the traffic operations analysis conducted in this TIS at the future horizon scenarios.

It is recommended that the needs and timing of the planned realignment to be reviewed by the Town and the Region as this and other future developments in the area progress.

3.2.1 Site Accesses

The land use concept plan (**Figure 3-1**) for Block Plan Area 9 proposes an internal road network that connects to Port Davidson Road to the west, Townline Road to the north, and Shurie Road and Alma Road to the east.

The proposed Block Plan Area 9 development includes the following accesses and connections to through roads:

- Three (3) accesses connected to Townline Road to the north – Sterling Street, Street B, and Rock Street (Street A);
- Three (3) accesses connected to Port Davidson Road – the Street D, Street F, and Unnamed Street South;
- Connection to Shurie Road; and,
- Connection to Alma Drive.

3.2.2 Transit Opportunities

According to the *Niagara Region TMP*, it is identified that there could be inter-municipal transit that is fixed-route between Grimsby, Smithville, and Port Colborne by the year 2041. The existing NRT OnDemand services will be promoted until that time.

The land use concept plan does not incorporate any provision for transit service at this time.

3.2.3 Active Transportation Network Connections

The land use concept plan (**Figure 3-1**) proposes an integrated active transportation network which is composed of three main multi-use trails for pedestrians and cyclists:

- A north-south trail along the eastern boundary of Phase 1 Development, running between Street A and Shurie Road – This trail will become part of the future Old Rail Trail which connect the other two east-west trails below within Phase 1 Development and provides access to the sidewalks and future on-street bike lanes on Townline Road, as outlined in the *Smithville TMP*.
- An east-west trail running close to the northern boundary of Block Plan Area 9, connecting Phase 1 Development, the rest of Block Plan Area 9, and Port Davison Road – This trail will become part of the future Westover Express Trail which connects the communities along the south side of Townline Road as outlined in the *Smithville TMP,* and is expected to be extended eastward to Regional Road 20, and westward to the Tober Road realignment.
- A second east-west trail running along the southern boundary of the Block Plan Area 9 development – This trail will become part of the future South Loop Trail as outlined in the *Smithville TMP*.

Note that the Westover Express Trail and South Loop Trail are part of the planned bike infrastructure outlined in the Town's TMP, and are expected to be implemented by other land developments and/or the Town.

3.3 FUTURE BACKGROUND DEVELOPMENTS

The proposed developments of the East Smithville Secondary Plan Area – hereby known as Background Development #1 – and the Block Plan Area 9 outside of Phase 1 – hereby known as Background Development #2 – are included as part of the background traffic estimation in the future horizon.

During the Terms of Reference consultation process with the Township of West Lincoln and the Region of Niagara, the planned development in the East Smithville Secondary Plan Area was identified as a background development. The development is located south of the rail corridor – part of Canadian Pacific Kansas City Limited's Hamilton subdivision – and along St Catharines Street (Regional Road 20), between Industrial Park Road and Townline Road. Its land uses are illustrated in **Figure 3-3.** As per correspondence with Township Staff, provided in **Appendix B**, this development is planned to contain 725 residential units. No further development or traffic impact analysis information was available. Hence, assumption was made to distribute the planned units by residential density in the same proportion as the proposed Phase 1 development. The resulting distribution is illustrated in **Table 3.3**.

Table 3.3: Assumed Land Use Distribution for Planned East Smithville Secondary Plan Area Development

Land Use	# Units	% Total
Single Detached Dwellings	570	79%
Semi Detached Dwellings	44	6%
Townhouse Dwellings	111	15%
TOTAL	**725**	**100%**

In addition, for the purpose of traffic operations analysis, the Block Plan Area 9 development outside of Phase 1 was considered as a second background development. The assumed land use concept plan is shown in **Figure 3-3**.

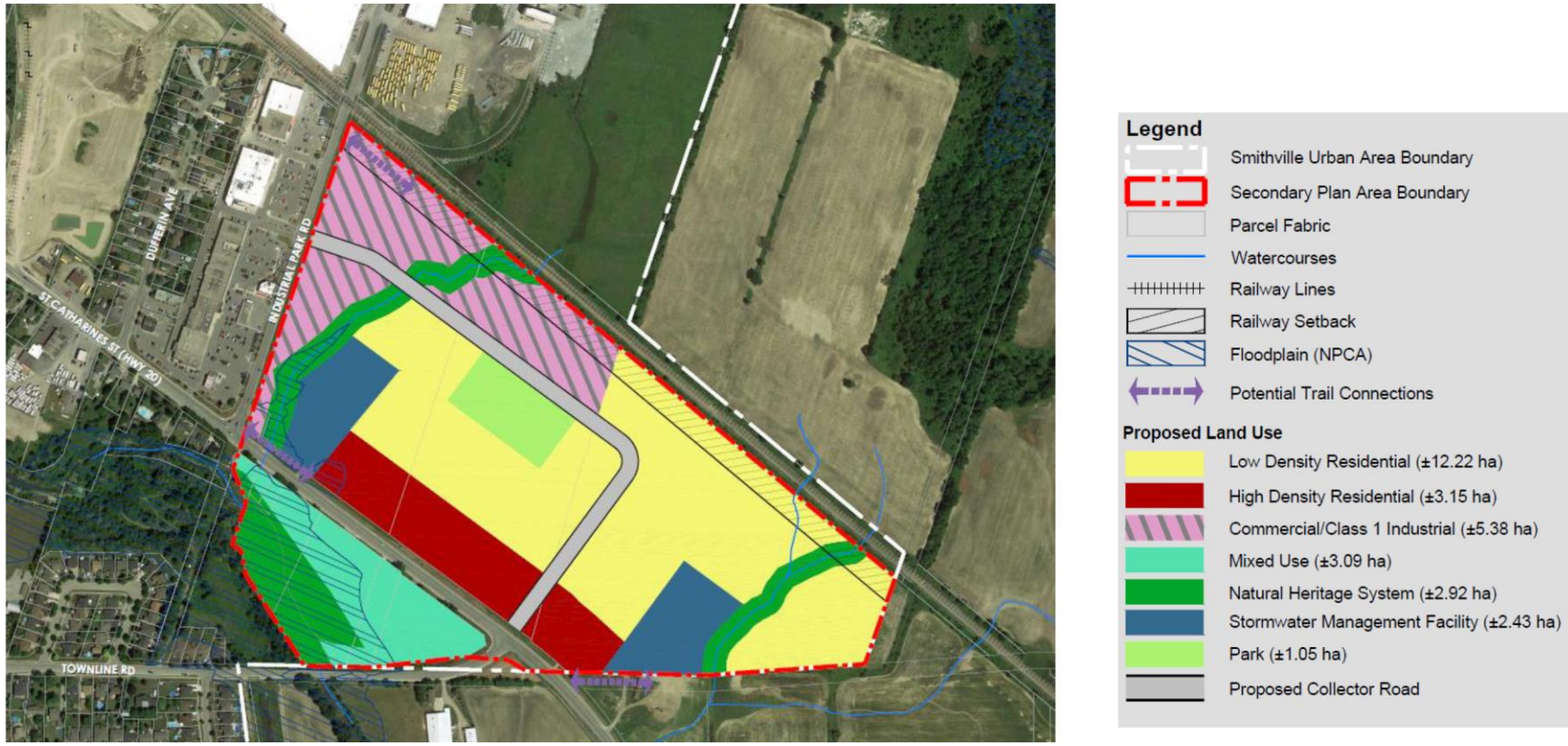


Figure 3-3: East Smithville Secondary Plan Area Land Use Option 1 (Source: East Smithville Secondary Plan Council Meeting, February 2021)

4.0 SITE TRIPS

4.1 TRIP GENERATION

Vehicular trip generation for the proposed land use in Block Plan Area 9, Phase 1 and without Phase 1, and East Smithville Secondary Plan Area were calculated using the Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 11th Edition*. The vehicular trip generation calculation is based on ITE Land Use Code (LUC) 210 (Single Family Detached Housing) and 215 (Single Family Attached Housing). These two categories are used for the estimation of low density (single family detached dwellings) and medium density residential (semi-detached dwellings and townhouse dwellings) units, respectively. Both the Average Rate Method and the Fitted Curve Method were used to generate vehicle trips for each land use category. The method that generates the larger number of trips was applied.

The vehicular trip generation results for each of the aforementioned development are provided in **Table 4.1** and summarized as follows:

- Phase 1 Development: 37 inbound and 111 outbound trips are estimated in the AM peak hour, and 122 inbound and 74 outbound trips are estimated in the PM peak hour.
- East Smithville Secondary Plan development: 119 inbound and 355 outbound trips in the AM peak hour, and 391 inbound and 235 outbound trips in the PM peak hour.
- Block Plan Area 9 Development, without Phase 1: 122 inbound and 365 outbound trips in the AM peak hour, and 389 inbound and 240 outbound trips in the PM peak hour.

Table 4.1: Vehicular Trip Generation Results by Development

Land Use Code	Variable	Units	Trip Generation Rates	Total Trip Generation	IN		OUT	
					%	#	%	#
Phase 1 Development - Block Plan Area 9								
AM Peak Hour								
210	Dwelling Units	154	Ln(T) = 0.91 Ln(X) + 0.12	125	25%	31	75%	94
215	Dwelling Units	42	0.48 Trips Per Unit	22	25%	6	75%	17
			Total	**147**		**37**		**111**
PM Peak Hour								
210	Dwelling Units	154	Ln(T) = 0.94 Ln(X) + 0.27	170	63%	107	37%	63
215	Dwelling Units	42	0.57 Trips Per Unit	26	59%	15	41%	11
			Total	**196**		**122**		**74**
Background Development 1 - East Smithville Secondary Plan								
AM Peak Hour								
210	Dwelling Units	570	0.7 Trips Per Unit	399	25%	100	75%	299
215	Dwelling Units	155	T = 0.52(X) - 5.70	75	25%	19	75%	56
			Total	**474**		**119**		**355**
PM Peak Hour								
210	Dwelling Units	570	0.94 Trips Per Unit	536	63%	338	37%	198
215	Dwelling Units	155	T = 0.60(X) - 3.93	89	59%	53	41%	37
			Total	**625**		**391**		**235**
Background Development 2 - Block Plan Area 9, without Phase 1								
AM Peak Hour								
210	Dwelling Units	547	0.7 Trips Per Unit	335	25%	84	75%	251
215	Dwelling Units	268	T = 0.52(X) - 5.70	152	25%	38	75%	114
			Total	**487**		**122**		**365**
PM Peak Hour								
210	Dwelling Units	547	0.94 Trips Per Unit	450	63%	284	37%	167
215	Dwelling Units	268	T = 0.60(X) - 3.93	178	59%	105	41%	73
			Total	**628**		**389**		**240**

4.2 TRIP DISTRIBUTION AND ASSIGNMENT

The trips generated by the proposed developments were distributed based on the information extracted from the Appendices of the Town's *Smithville TMP*, including:

- Appendix A, Table 30: Contains the estimated number of trips under the 2051 Projected Background Traffic AM peak scenario, split into four categories:
    - Internal-to-internal (I-I) trips: 880 trips;
    - Internal-to-external (I-X) trips: 1,995 trips;
    - External-to-internal (X-I) trips: 1,340 trips; and,
    - External-to-external (X-X) trips: 1,578 trips.

  This implies that I-I trips (880 trips) represent 31% of total trips originated in Smithville (2,875 trips) and represent 40% of total trips destined in Smithville (2,220 trips).
- Appendix A, Table 26: Contains observed volumes at corridor limits of the Smithville model area, as shown in **Table 4.2**. The distribution of observed volumes is then calculated – field "Assumed Distribution" – and used to distribute external trips to the various external gateways that enter and exit the urban boundaries of Smithville.

Note that the *Smithville TMP* does not provide PM peak hour model results.

Based on this information, the following assumptions were applied to trips generated from the proposed Block Plan Development, Phase 1 and without Phase 1, and the East Smithville Secondary Plan Area Development:

- In the AM peak hour, 31% of trips generated by each development were assigned as internal trips to/from locations in Smithville (I-I), and 69% were assigned as external trips to/from locations outside of Smithville (I-X and X-I). This assumes that the proportion of I-X trips in the *Smithville TMP*'s 2051 Projected Background Traffic AM peak scenario represent both inbound (I-X) and outbound (X-I) external trips in the future horizon AM peak hour.
- In the PM peak hour, 40% of trips generated by each development were assigned as internal trips to/from locations in Smithville (I-I), and 60% were assigned as external trips to/from locations outside of Smithville (I-X and X-I). This assumes that the proportion of X-I trips in the *Smithville TMP*'s 2051 Projected Background Traffic AM peak scenario represent both inbound (I-X) and outbound (X-I) external trips in the future horizon PM peak hour.

- Internal trips are distributed as follows, based on existing relative development density in Smithville:
    - To/from Town Centre via Canborough Street: 45%
    - To/from Village Square and Industrial Park via Townline Road and St Catharines Street (Regional Road 20): 45%
    - To/from Townline Road West: 10%
- External trips are distributed to external gateways as illustrated in **Table 4.2**.

Table 4.2: Trip Distribution of External Trips by External Gate (Source: Smithville Transportation Master Plan, 2023)

Roadway	External Gate	Observed Volume (Weekday AM Peak Hour)	Assumed Distribution
Regional Rd 14 / Canborough Street	North Gate (North)	260	17%
Smithville Rd / Townline Rd	West Gate (West)	215	14%
Regional Rd 20	West Gate (Northwest)	458	29%
Regional Rd 20	East Gate (East)	517	33%
Port Davidson Rd	South Leg (South)	119*	8%*

*Note: South gate data is not available in the *Smithville TMP*. The observed volume and percentage were estimated by comparing the existing traffic count data at the south legs of Regional Rd 20/Townline Rd and the Port Davidson Rd/Townline Rd intersections and applying the compared ratio (23%) to the observed trip value at the East Gate.

Based on the assumptions outlined above, the trip distribution of the development trips is summarized in the **Table 4.3** below.

Table 4.3: Trip Distribution Summary for Block Plan Area 9 and Phase 1 Developments

Type	Distribution		Origin/Destination	Assumed Distribution
	AM Peak	PM Peak		
Internal-to-Internal	31%	40%	to/from Town Centre via Canborough St	45%
			to/from Village Square and Industrial Park via Townline Road and St Catharines St (RR20)	45%
			to/from Townline Road West	10%
Internal-to External (Out), External-to-Internal (In)	69%	60%	to/from North via Canborough St (North)	17%
			to/from North via Townline Road and St Catharines St (RR20) (North)	
			to/from Northwest via Canborough St to RR20 (Northwest)	29%
			to/from Northwest via Townline Road and St Catharines St (RR20) (Northwest)	
			to/from West via Townline Road West (West)	14%
			to/from East via Townline Road East to RR20 (East)	33%
			to/from South via Port Davidson Rd	8%

Table 4.4: Trip Distribution for East Smithville Secondary Plan Developments

Type	Distribution		Destination	Distribution
	AM Peak	PM Peak		
Internal-to-Internal	31%	40%	to/from Town Centre via RR20	45%
			to/from Village Square and Industrial Park via Townline Road and St Catharines St (RR20)	45%
			to/from Townline Road West	10%
Internal-to External (Outbound), External-to-Internal (In)	69%	60%	to/from North via Townline Road and St Catharines St (RR20) (North)	17%
			to/from Northwest via Canborough St to RR20 (Northwest)	29%
			to/from West via Townline Road West (West)	14%
			to/from East via RR20 (East)	33%
			to/from South via Townline Road West to Port Davidson Rd (South)	8%

The distributed trips are then further assigned to the study road network based on the following assumptions:

- Phase 1 Development:
  - Equal distribution between Rock Street (Street A) and Street B for trips accessing Townline Road.
  - Equal distribution between Street D and Street F for trips accessing Port Davidson Road.
- East Smithville Secondary Plan Area Development (Background Development #1):
  - All trips to/from Village Square or Industrial Park will be accessing via Industrial Park Road.
  - All trips to/from the west part of the town, west gate, south gate, or east gate will access via the Townline Road/Regional Road 20 roundabout.
  - 70% of trips to/from Town Centre, north gate, or northwest gate will access via the Townline Road/Regional Road 20 roundabout, and the remaining 30% will access via Industrial Park Road.

- Block Plan Area 9 Development outside of Phase 1 (Background Development #2):
    - Equal distribution between Rock Street (Street A), Street B, Sterling Street and Shurie Road for trips accessing Townline Road.
    - Equal distribution between Street D, Street F and Unnamed Road South for trips accessing Port Davidson Road.

Figure 4-1, **Figure 4-2, Figure 4-3** and **Figure 4-4** show the AM and PM peak hour trip assignment percentage and assigned trips for Phase 1 Development, respectively.

Figure 4-5, **Figure 4-6**, **Figure 4-7** and **Figure 4.8** show the AM and PM peak hour trip assignment percentage and assigned trips for East Smithville Secondary Plan, respectively.

Figure 4-9, **Figure 4-10**, **Figure 4-11** and **Figure 4-12** show the AM and PM peak hour trip assignment percentage and assigned trips for Block Plan Area 9, without Phase 1, respectively.

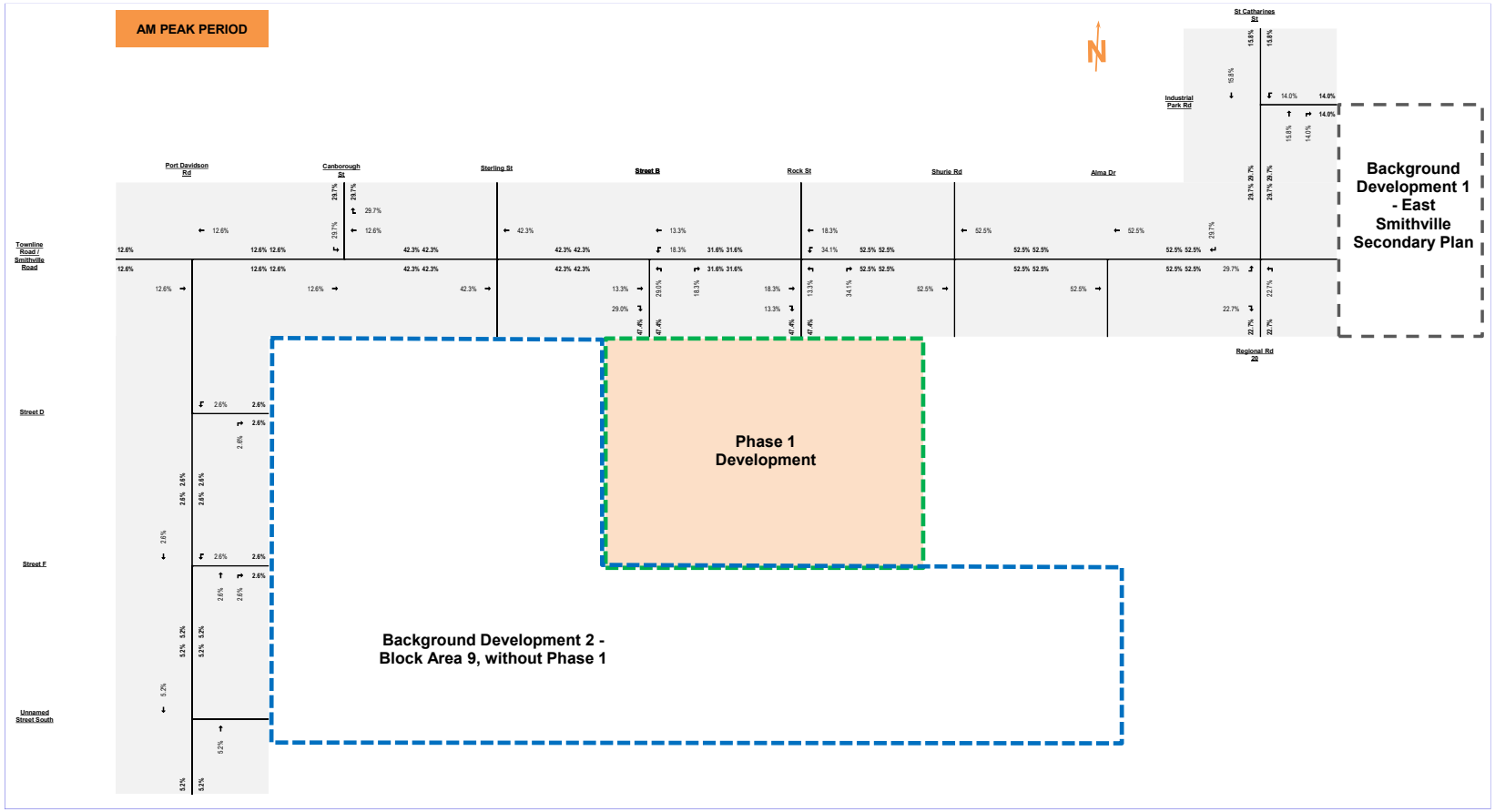


Figure 4-1: Phase 1 Development Trip Assignment Percentage - AM Peak Hour

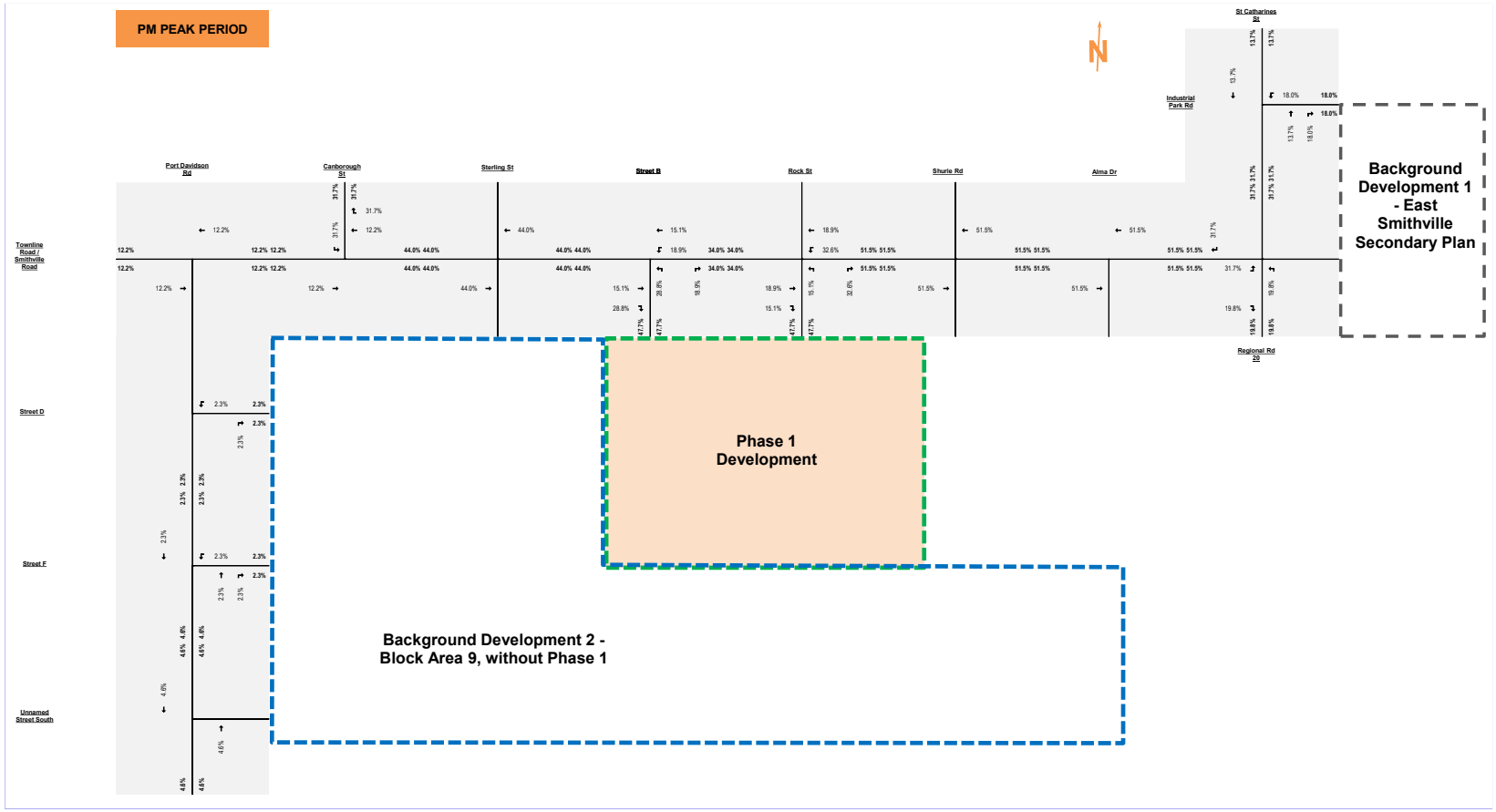


Figure 4-2: Phase 1 Development Trip Assignment Percentage - PM Peak Hour

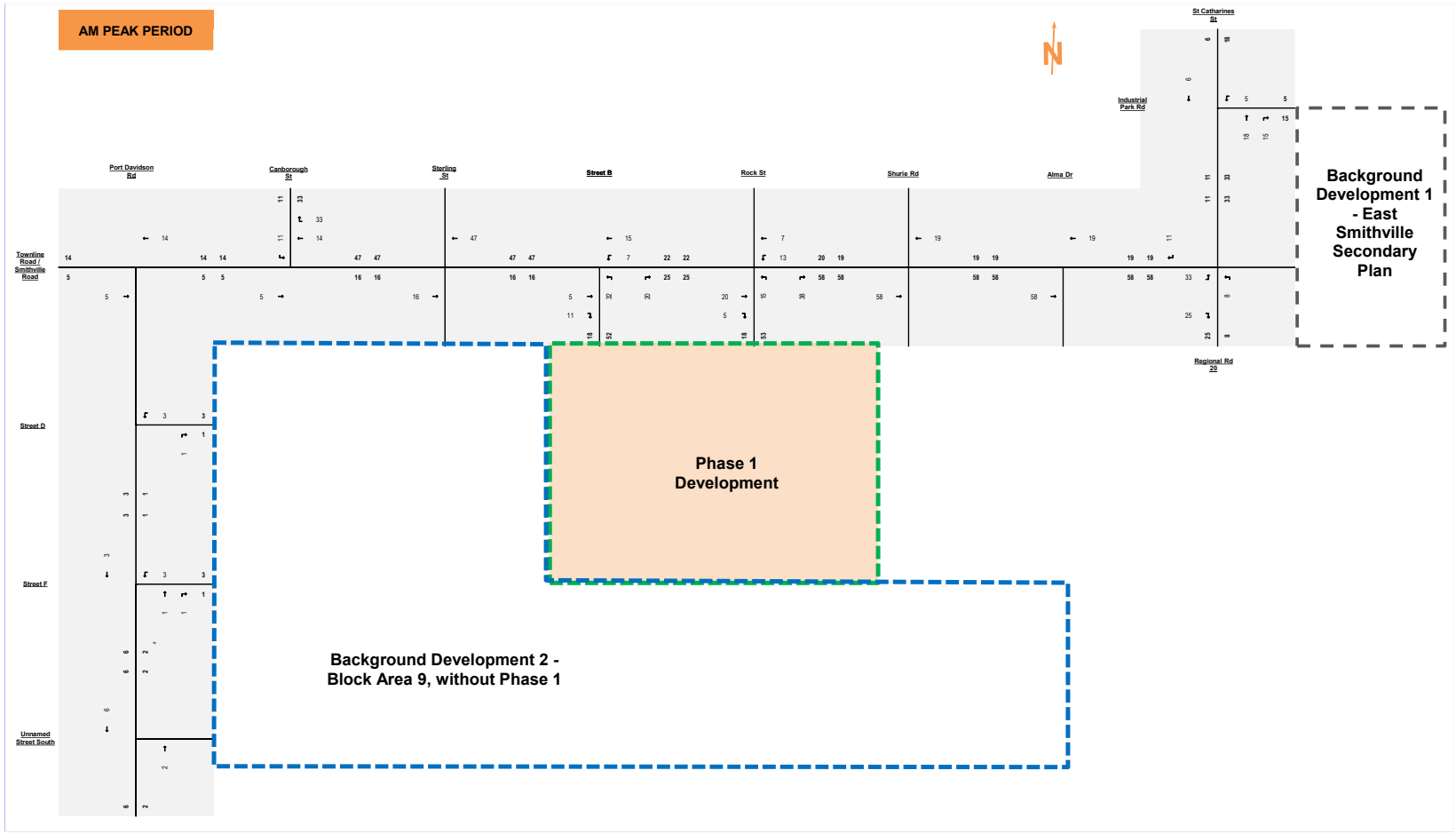


Figure 4-3: Phase 1 Development Site-generated Volume - AM Peak Hour

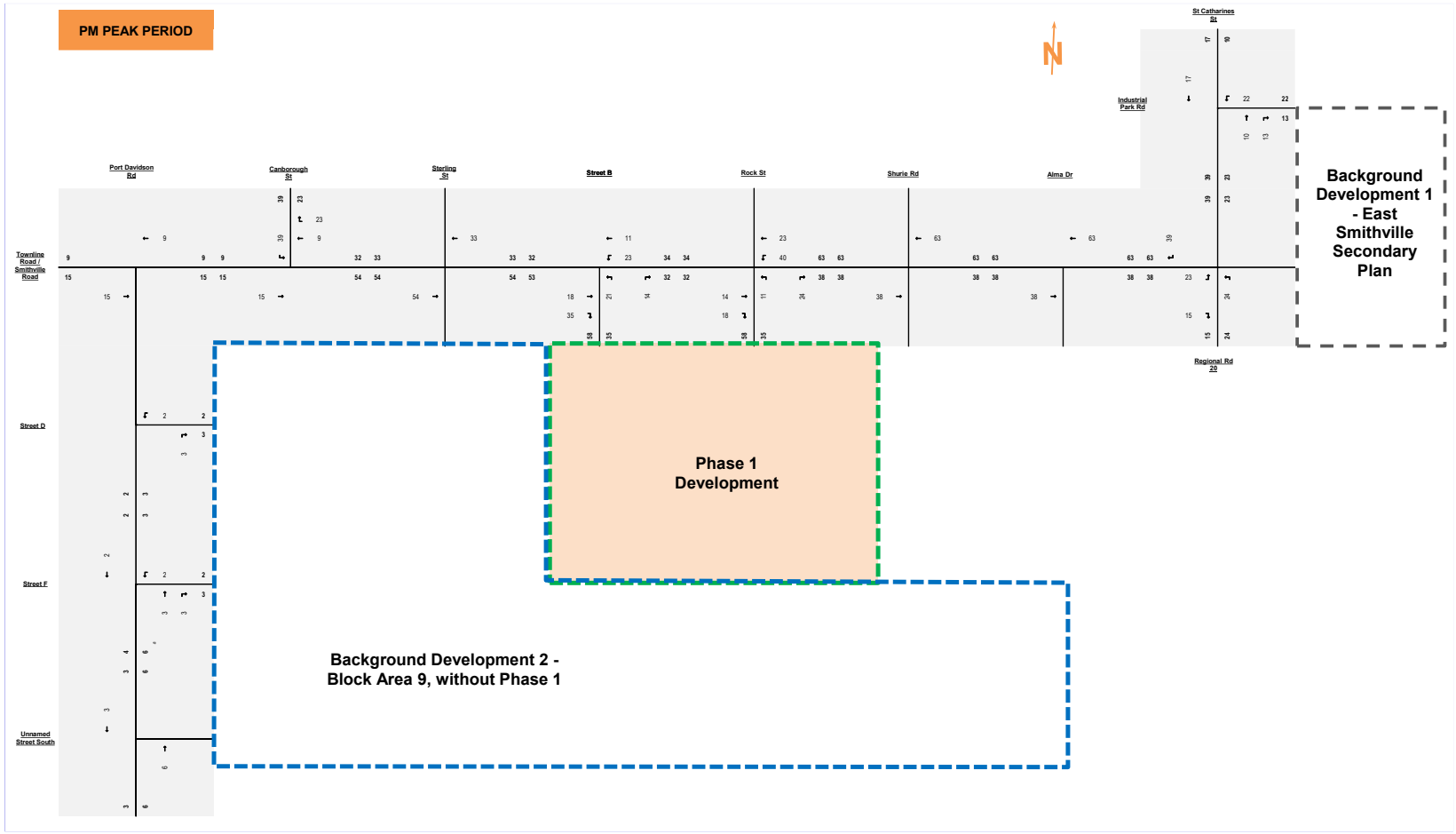


Figure 4-4: Phase 1 Development Site-generated Volume - PM Peak Hour

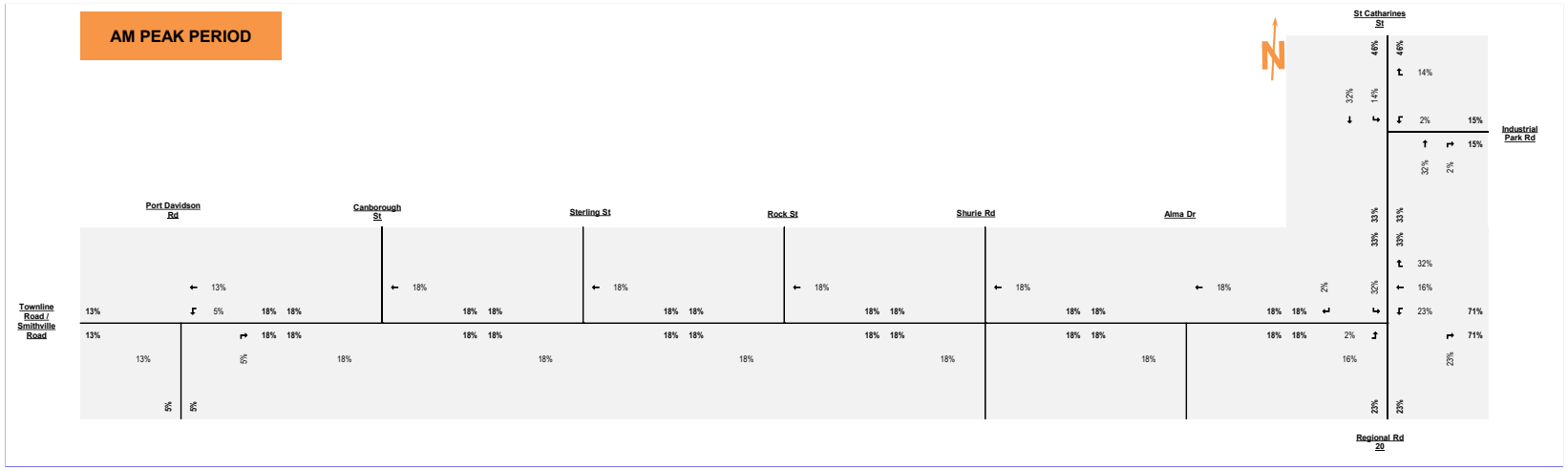


Figure 4-5: East Smithville Secondary Plan Trip Assignment Percentage - AM Peak Hour

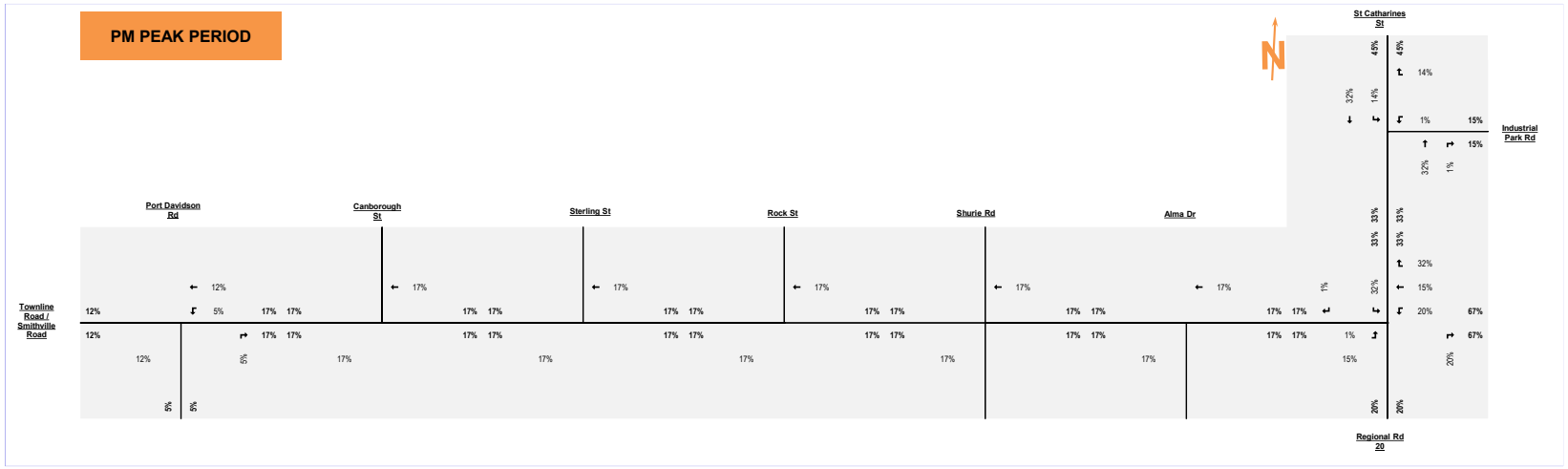


Figure 4-6: East Smithville Secondary Plan Trip Assignment Percentage - PM Peak Hour

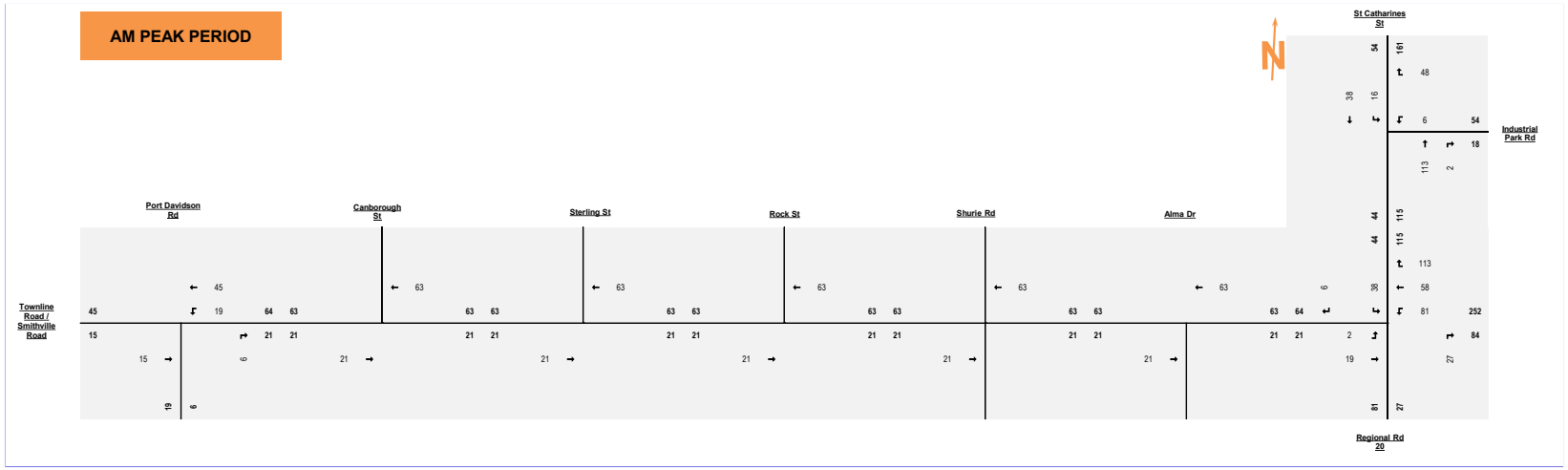


Figure 4-7: East Smithville Secondary Plan Site-generated Volume - AM Peak Hour

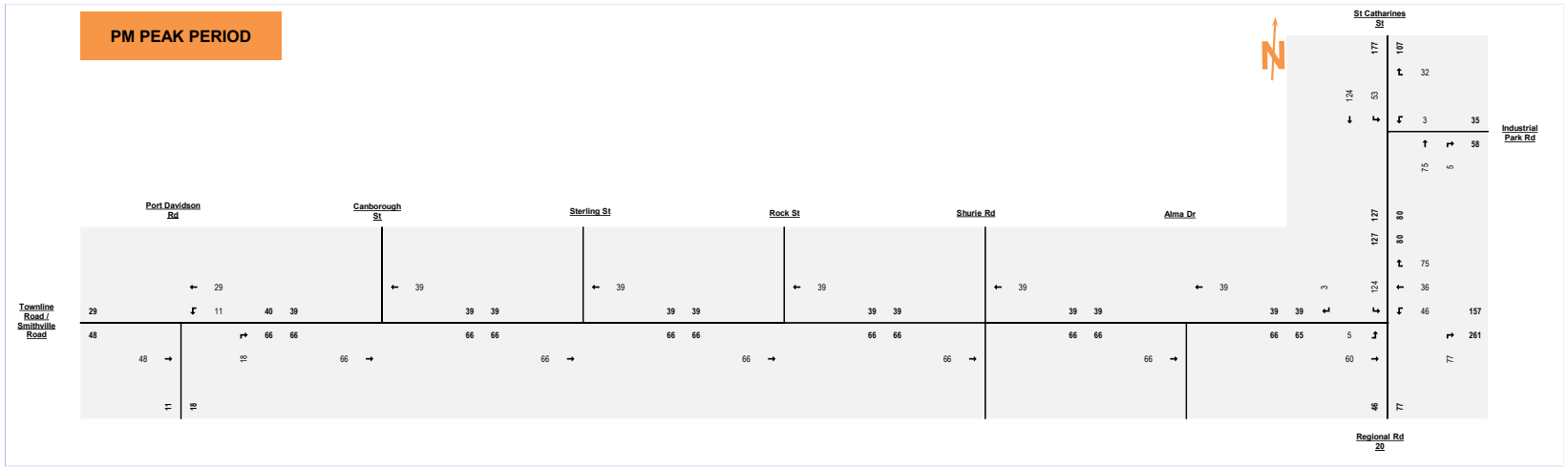


Figure 4-8: East Smithville Secondary Plan Site-generated Volume - PM Peak Hour

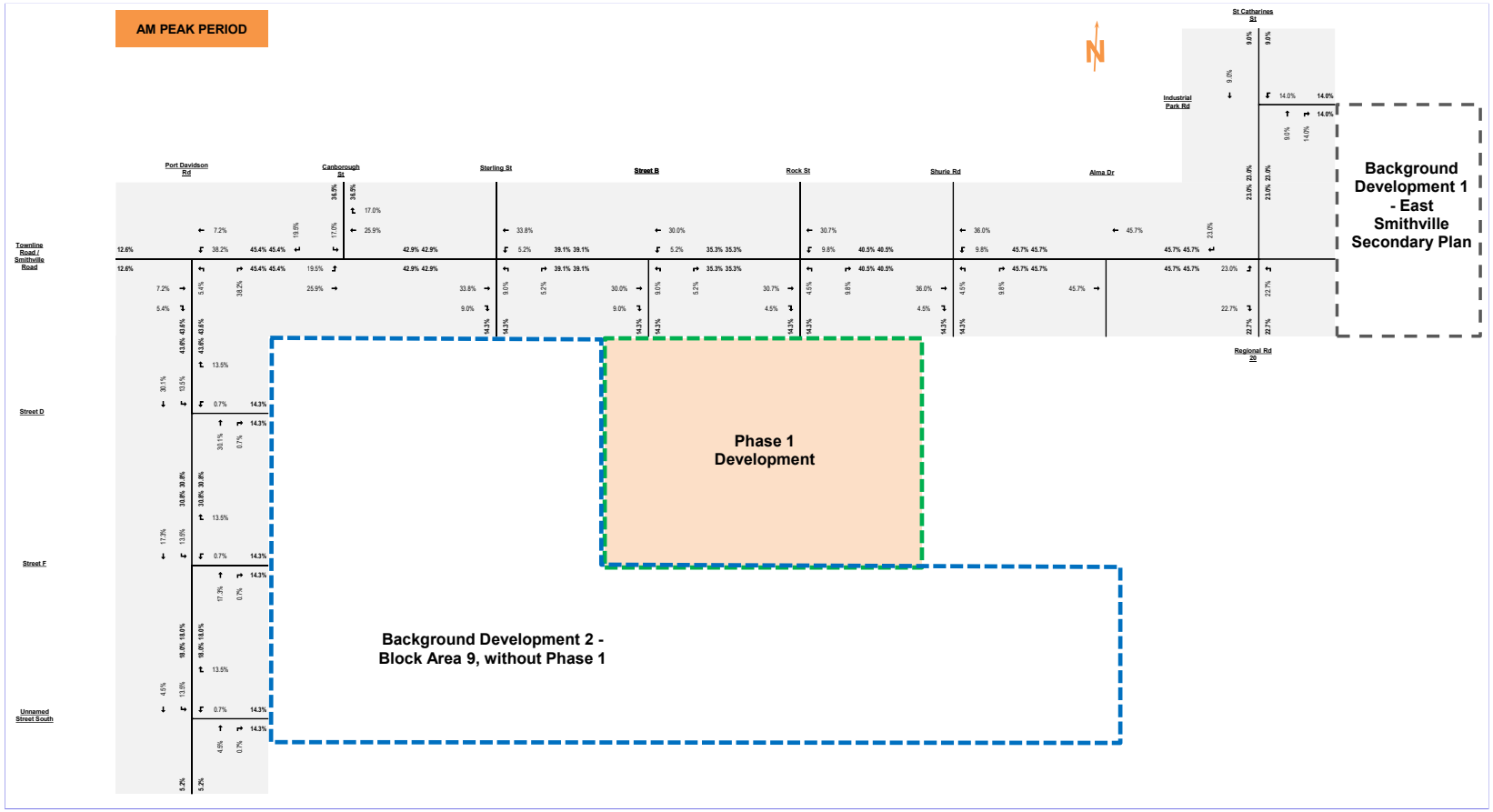


Figure 4-9: Block Plan Area 9, without Phase 1 Trip Assignment Percentage - AM Peak Hour

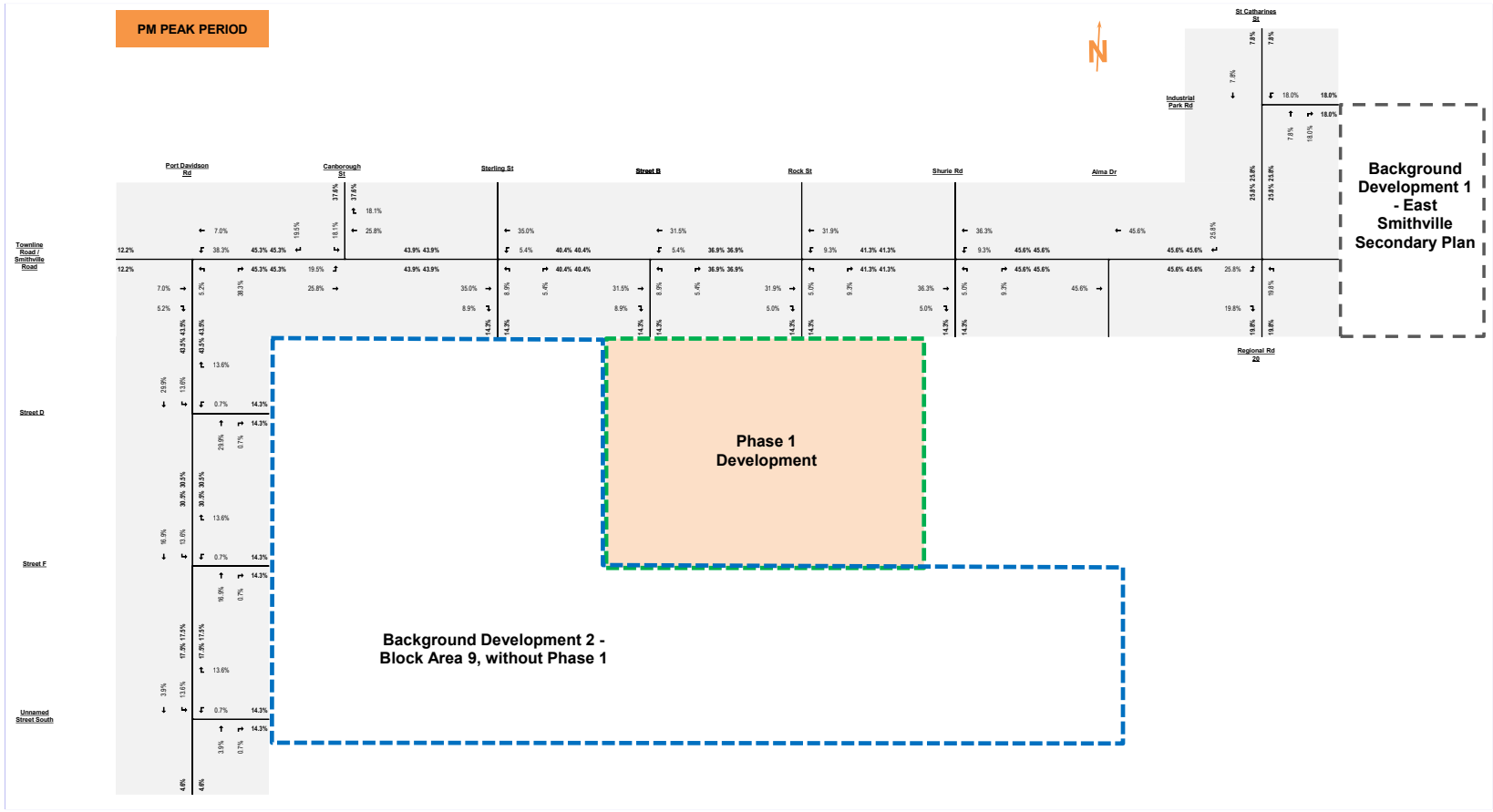


Figure 4-10: Block Plan Area 9, without Phase 1 Trip Assignment Percentage - PM Peak Hour

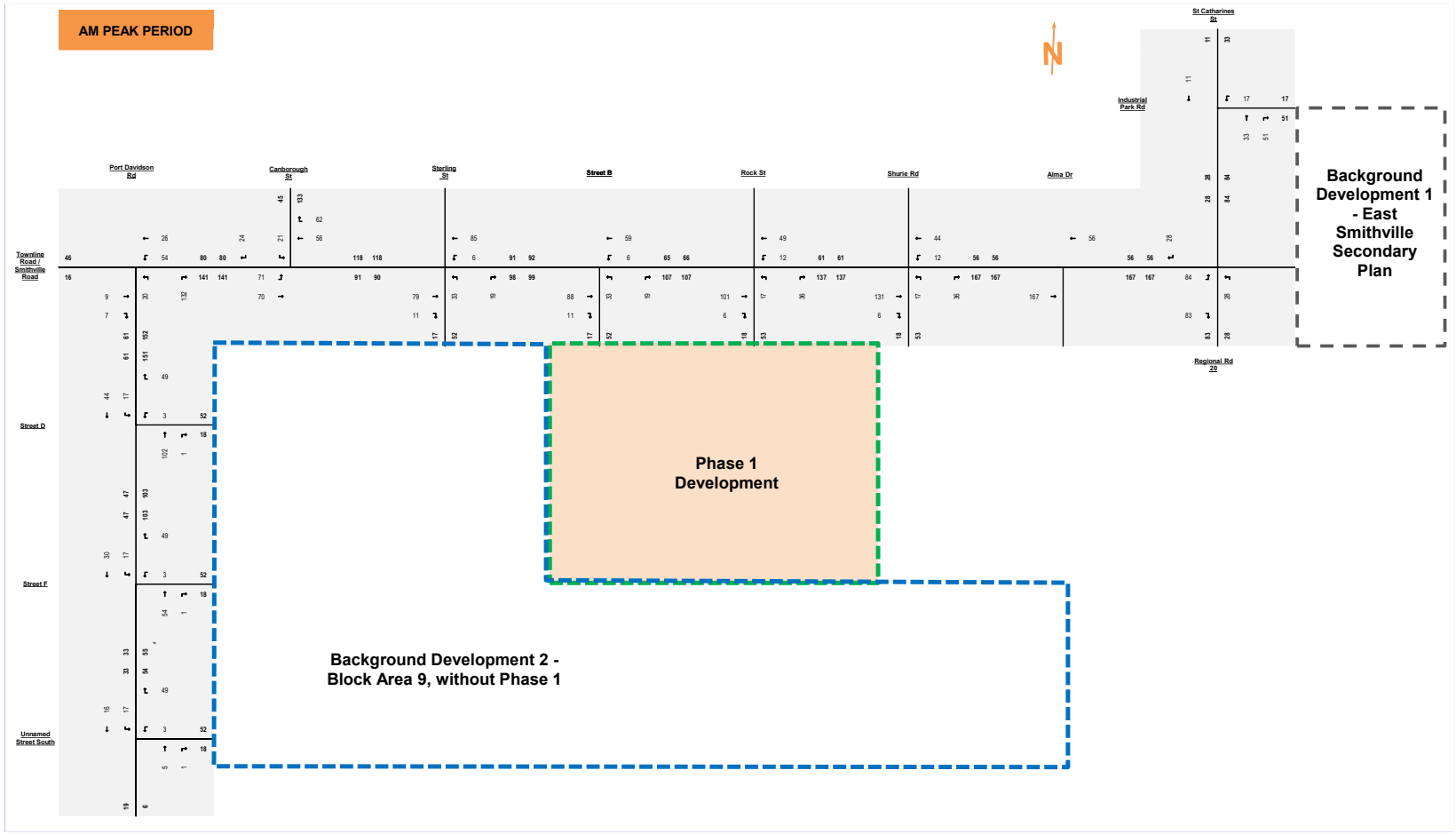


Figure 4-11: Block Plan Area 9, without Phase 1 Site-generated Volume - AM Peak Hour

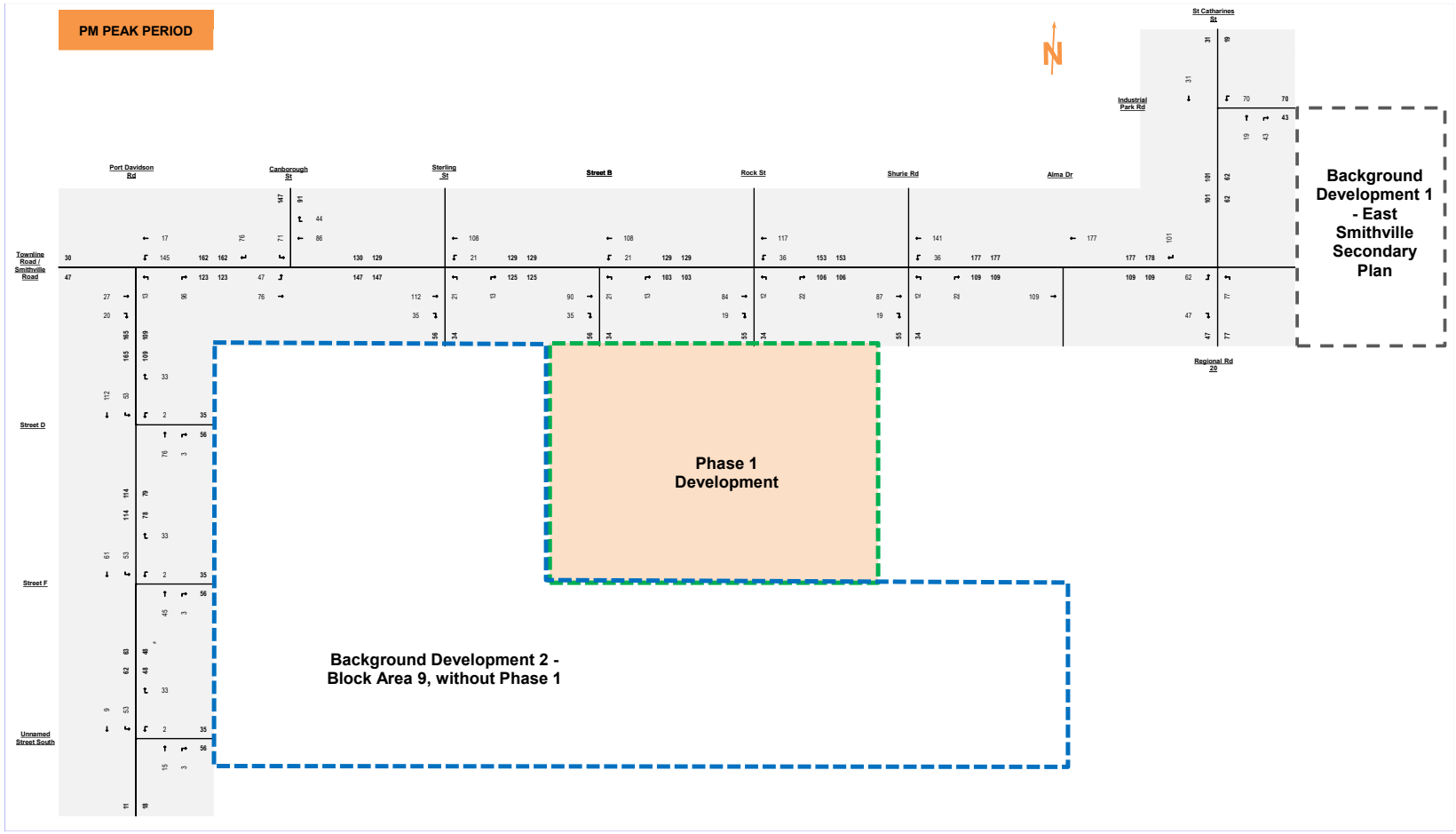


Figure 4-12: Block Plan Area 9, without Phase 1 Site-generated Volume - PM Peak Hour

5.0 TRAFFIC OPERATIONS ANALYSIS

5.1 METHODOLOGY

The traffic operations analyses for the study area intersections were conducted based on Niagara Region's *Transportation Impact Assessment (TIA) Guidelines (2023)*. As outlined in **Section 1.3**, the following scenarios were evaluated in this study:

- Existing conditions in 2024;
- Future background traffic without Phase 1 development in 2030;
- Future total traffic with Phase 1 development in 2030.

For all selected scenarios, traffic volumes during the weekday AM and PM peak hours were utilized for the analyses.

The operations of the study area intersections were evaluated in terms of level of service (LOS) and volume to capacity (v/c) as defined by the Highway Capacity Manual (HCM). The 95th percentile queue lengths at intersection movements were also evaluated as compared to the available turning lane storage capacity.

LOS was evaluated based on the average control delay per vehicle and includes deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Capacity was evaluated in terms of ratio of demand flow to capacity with an at-capacity condition represented by a v/c ratio of 1.00 (i.e. volume demand equals capacity). The LOS criteria for unsignalized intersections are defined in **Table 5.1.**

Table 5.1: Level of Service Criteria, Unsignalized Intersections

LOS	Delay (seconds/veh)
A	≤10s
B	>10s and ≤15s
C	>15s and ≤25s
D	>25s and ≤35s
E	>35s and ≤50s
F	>50s

To assess the traffic conditions for study scenarios, LOS analyses were undertaken for the study area stop-controlled intersections using Cubic's Synchro 11 platform and HCM 2000 methodology, and for the study area roundabout intersection using TRL Software's ARCADY 9 module and HCM 2010 methodology. The key parameters used in the analysis include:

- Existing lane configurations;
- Heavy vehicle (HV) percentages as derived from collected traffic count data;
- Peak hour factor (PHF) of 0.92 for all movements; and,
- Synchro and ARCADY default values for all other inputs.

Critical movements were identified if one or more of the following criteria is satisfied:

- Level of service (LOS) of “D” or worse at unsignalized intersections (based on the Niagara Region’s *TIA Guidelines, 2023)*;
- 95th percentile queue length exceeds the storage lane capacity (based on the Niagara Region’s *TIA Guidelines, 2023)*; or,
- Vehicle queuing negatively affects upstream or downstream intersections.

5.2 EXISTING CONDITIONS SCENARIO (2024)

As outlined in **Section 1.2**, the traffic count data at the Townline Road and Industrial Park Road was collected in 2023, while the traffic count data collected at other study area intersections were collected in 2024. A minor adjustment was made to the northbound traffic volumes at the Townline Road and Industrial Park Road intersection to balance its traffic volume with the upstream intersection at the Townline Road and St Catharines Street (Regional Road 20) intersection. No other significant traffic volume imbalance is found in the network.

The full traffic count dataset is provided in **Appendix A**.

5.2.1 Traffic Volume Estimation along Townline Road at Sterling Street and Rock Street

As shown in **Figure 3-1** and **Figure 3-2**, two future accesses will be connected to existing Townline Road intersections – one access from the proposed Phase 1 Development will be connected to the existing Rock Street and Townline Road intersection, and another access from the Block Plan Area 9 Development will be connected to the existing Sterling Street and Townline Road intersection. No traffic count data was collected at these two intersections.

The traffic volumes from the north legs of these two intersections were estimated based on the numbers of properties facing Rock Street, Sterling Street, David Street and Ellis Street in the residential area to the north of Townline Road, using ITE's *Trip Generation Manual, 11th Edition*. The estimated traffic volumes were then equally distributed to the three accesses to the residential area. The vehicular trip generation results are attached in **Appendix C** and summarized as follows:

- Sterling Street and Townline Road: 5 inbound and 15 outbound trips in the AM peak hour, and 16 inbound and 9 outbound trips in the PM peak hour.
- Rock Street and Townline Road: 5 inbound and 15 outbound trips in the AM peak hour, and 16 inbound and 9 outbound trips in the PM peak hour.

Upon reviewing the existing traffic data, the estimated north leg traffic volumes of these two intersections were equally distributed to the westbound and eastbound travel directions.

5.2.2 Traffic Volume

The traffic volume distribution for the weekday AM and PM peak hours in the existing conditions is illustrated in **Figure 5-1** and **Figure 5-2**.

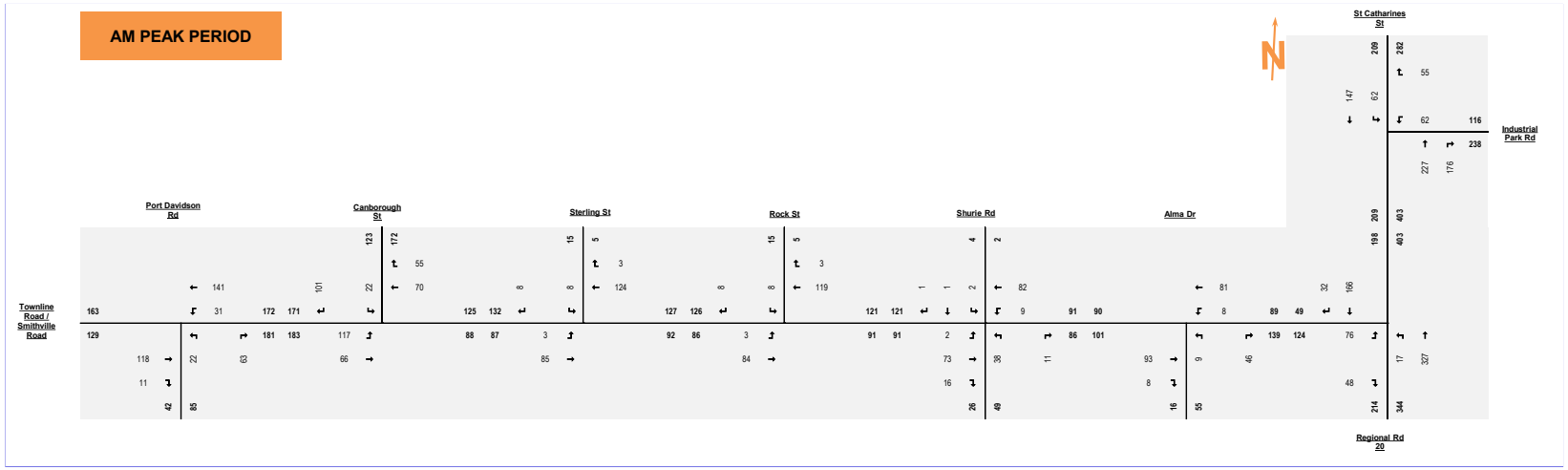


Figure 5-1: Existing Conditions Scenario (2024) – Weekday AM Peak Hour Traffic Volumes

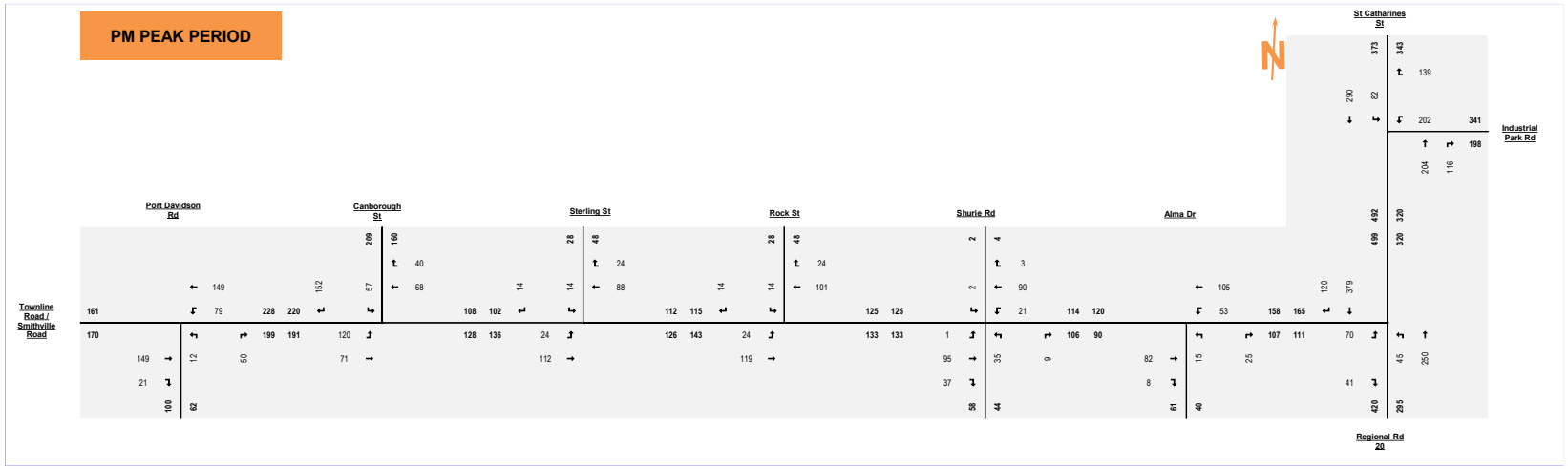


Figure 5-2: Existing Conditions Scenario (2024) – Weekday PM Peak Hour Traffic Volumes

5.2.3 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the existing conditions scenario for the signalized study area intersection is presented in **Table 5.2** and **Table 5.3**. Synchro outputs for this scenario are included in **Appendix D**. ARCADY outputs for this scenario are included in **Appendix E**.

All existing intersections in the study area except for the St Catharines Street and Industrial Park Road intersection are anticipated to operate within capacity, with each movement performing at LOS B or better during both the AM and PM peak hours.

For the St Catharines Street and Industrial Park Road intersection, during the PM peak, the southbound left movement performs at LOS D, with a 95th percentile queue that exceeds the available storage by 9 metres. Upon further review, the intersection delay of 28.5 seconds, v/c ratio of 0.60, and 9-metres of storage deficit are considered acceptable for an urban intersection. Therefore, no further mitigation strategy is recommended.

Table 5.2: ICA Results (Existing Conditions Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
AM Peak Hour							
Townline Road and Port Davidson Road	2.9	WBLT	A	1.6	0.02	1	-
		NBLR	B	10.1	0.11	3	-
Townline Road and Canborough Street*	8.6	EBLT	A	9.3	0.25	7	-
		WBTR	A	8.2	0.16	4	-
		SBLR	A	8.1	0.16	4	-
Townline Road and Shurie Road*	7.9	EBLTR	A	7.8	0.13	4	-
		WBLTR	A	7.9	0.12	3	-
		NBLTR	A	7.8	0.07	1	-
		SBLTR	A	7.8	0.01	0	-
Townline Road and Alma Drive	2.4	WBLT	A	0.7	0.01	0	-
		NBLR	A	9.3	0.07	2	-
St Catharines Street (Regional Road 20) & Industrial Park Road	2.7	SBL	B	14.2	0.15	4	20
		SBR	B	10.2	0.08	2	-
		EBL	A	8.5	0.06	2	100
	0.8	EBLT	A	0.3	0.00	0	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Townline Road and Rock Street		SBLR	A	9.4	0.02	1	-
Townline Road and Sterling Street	2.7	WBL	B	14.2	0.15	4	20
		WBR	B	10.2	0.08	2	-
PM Peak Hour							
Townline Road and Port Davidson Road	2.9	WBLT	A	3.1	0.06	2	-
		NBLR	B	10.4	0.09	2	-
Townline Road and Canborough Street*	9.0	EBLT	A	9.5	0.27	8	-
		WBTR	A	8.2	0.15	4	-
		SBLR	A	8.9	0.27	8	-
Townline Road and Shurie Road*	7.9	EBLTR	A	7.9	0.16	4	-
		WBLTR	A	7.9	0.14	4	-
		NBLTR	A	7.9	0.06	0	-
		SBLTR	A	7.8	0.00	1	-
Townline Road and Alma Drive	2.8	WBLT	A	2.7	0.04	1	-
		NBLR	A	9.6	0.05	1	-
St Catharines Street (Regional Road 20) & Industrial Park Road	7.6	SBL	D	28.5	0.60	29	20
		SBR	B	10.4	0.18	5	-
		EBL	A	8.3	0.07	2	100
Townline Road and Rock Street	0.6	EBLT	A	0.5	0.01	0	-
		SBLR	A	9.6	0.01	0	-
Townline Road and Sterling Street	0.6	EBLT	A	0.5	0.01	0	-
		SBLR	A	9.5	0.01	0	-

* V/C ratio and 95th percentile queue are displayed based on HCM 6th Edition results for these intersections. 95th percentile queue was converted from vehicles to metres at 7 metres per vehicle.
** For the intersection of St Catharine Street and Industrial Park Road, St Catharines Street is considered an east-west roadway, and Industrial Park Road is considered a north-south roadway.

Table 5.3: ICA Results (Existing Conditions Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movement					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (veh)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	A	5.3	SB	A	4.4	0.17	1	-
			EB	A	4.4	0.12	0	
			NB	A	6.1	0.32	1	-
PM Peak Hour								
Townline Road and St Catharines Street	A	6.2	SB	A	7.0	0.42	2	-
			EB	A	5.4	0.14	1	
			NB	A	5.2	0.26	1	-

5.3 FUTURE BACKGROUND SCENARIO (2030)

In the future background scenario, the trips generated by the background developments identified in **Section 3.3** are merged into the projected traffic volumes from the existing conditions scenario. As discussed in **Section 1.4**, a conservative annual growth rate of 3% was applied to the existing conditions traffic volumes to project the traffic volumes for the future background scenario in the horizon year of 2030.

All site accesses for Block Plan Area 9 were added to the roadway network for analysis. All site access intersections were assumed to operate with stop control at the site approach. The proposed road configuration and intersection control in the future background scenario is shown in **Figure 5-3**.

5.3.1 Traffic Volume

The traffic volume distribution for future background scenario is illustrated in **Figure 5-4** and **Figure 5-5** for the weekday AM and PM peak hours**.**

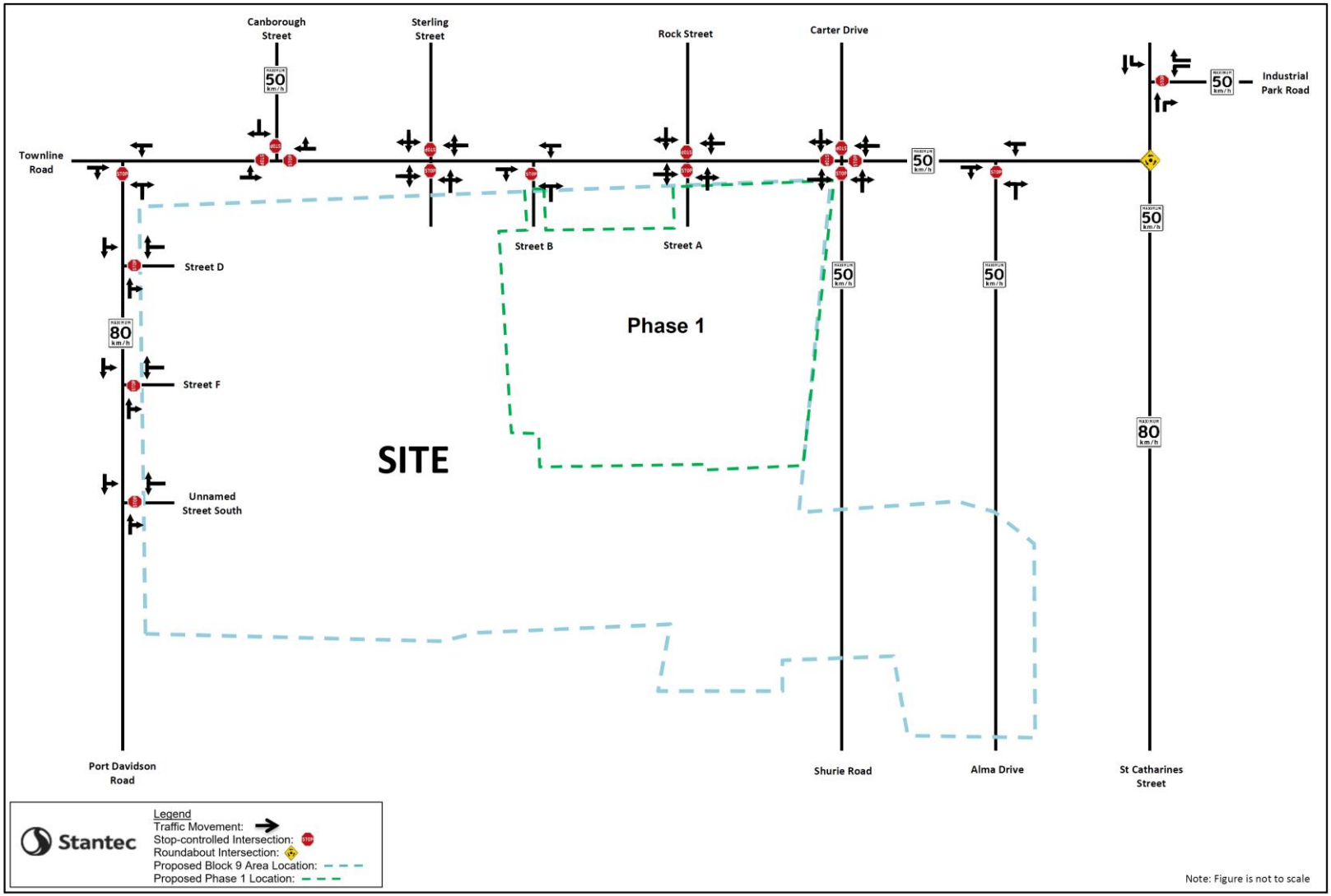


Figure 5-3: Future Lane Configuration and Intersection Control

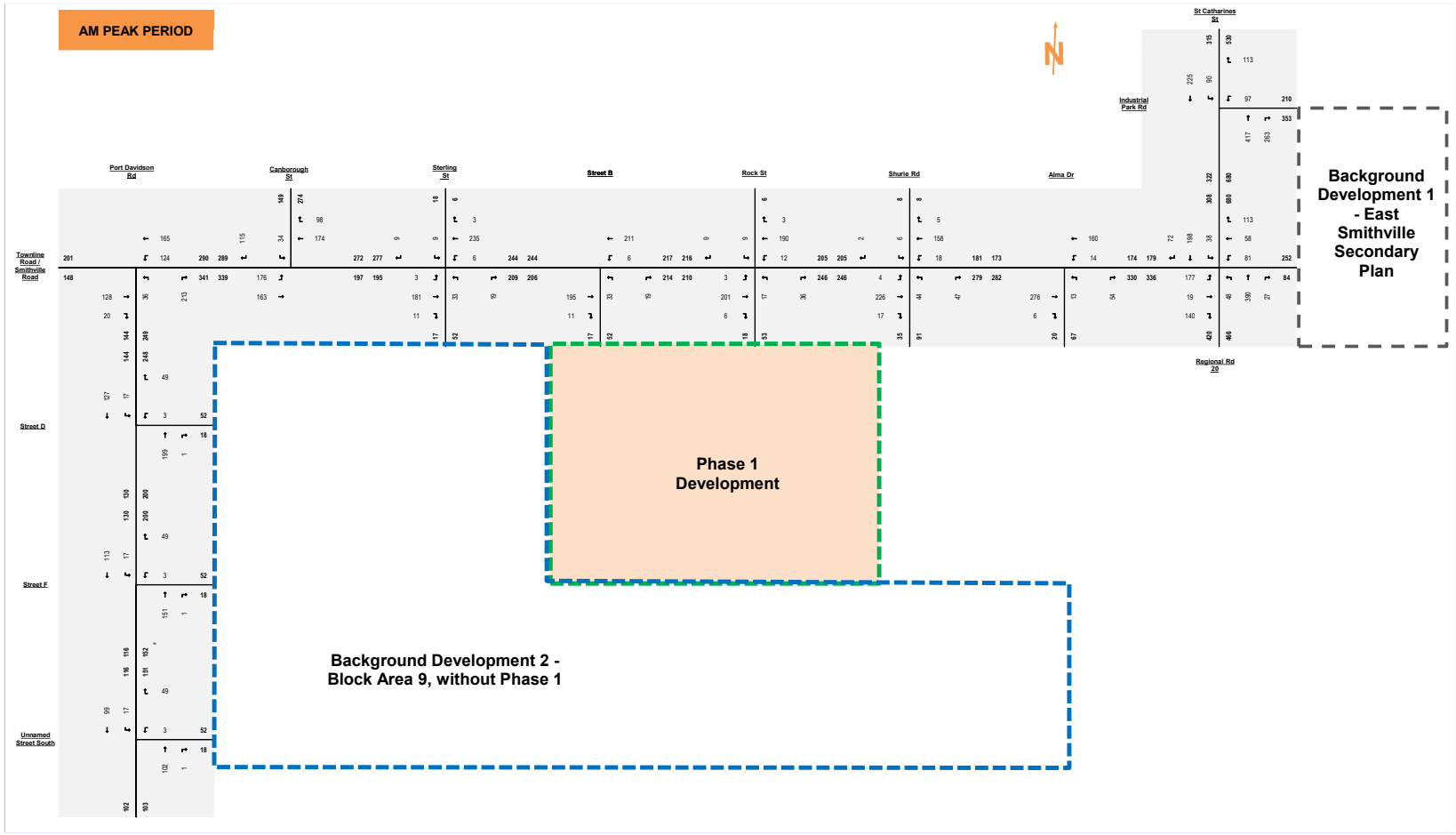


Figure 5-4: Future Background Scenario (2030) – Weekday AM Peak Hour Traffic Volumes

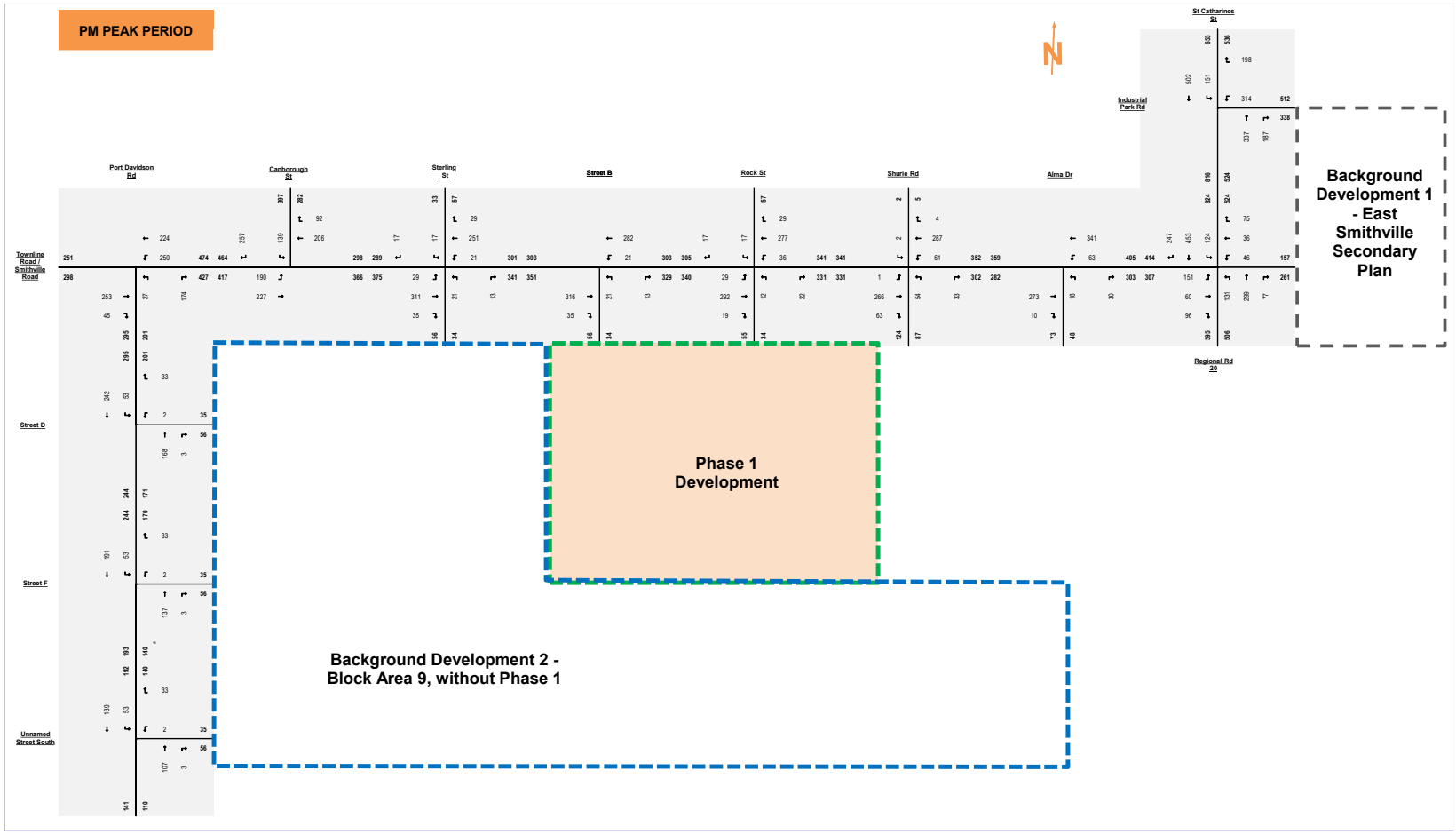


Figure 5-5: Future Background Scenario (2030) – Weekday PM Peak Hour Traffic Volumes

5.3.2 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the future background scenario for the study area intersections are presented in **Table 5.4** and **Table 5.5**. Synchro outputs for this scenario are included in **Appendix F.** ARCADY outputs for this scenario are included in **Appendix G**.

All intersections in the study area, except for the St Catharines Street and Industrial Park Road intersection, are anticipated to operate within capacity with each movement performing at LOS C or better during both the AM and PM peak hours.

St Catharines Street and Industrial Park Road: In this scenario, it is noted that the southbound left movement at the St Catharines Street and Industrial Park Road intersection performs at LOS D during the AM peak hour and LOS F during the PM peak hour. The 95th percentile queue of the southbound left movement also exceeds the storage length of the movement in the PM peak hour. In addition, projected traffic volumes in the future background scenario meets traffic signal warrant thresholds, as indicated in **Appendix H**.

As a result, based on the available information, a traffic signal is recommended at this intersection to mitigate the anticipated critical operations. The storage length of the southbound left movement is also recommended to be extended to 60 metres.

The ICA results of the mitigation scenario and pre-mitigation scenario at this intersection are presented in **Table 5.6**.

The majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area. Given that the available traffic information for the East Smithville Secondary Plan Area is limited, and that the scale of development and the distribution of these trips are based on high-level assumptions, the current assumptions are expected to be further studied in future development plans. Therefore, it is recommended that further traffic analysis be conducted as part of the proposed development applications in the area to assess the potential traffic impacts and review the need for traffic signalization at this intersection.

Table 5.4: ICA Results (Future Background Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
AM Peak Period							
Townline Road and Port Davidson Road	5.9	WBLT	A	3.5	0.10	3	-
		NBLR	B	13.1	0.38	13	-
Townline Road and Canborough Street*	13.1	EBLT	B	14.9	0.55	24	-
		WBTR	B	12.4	0.47	18	-
		SBLR	B	10.7	0.29	8	-
Townline Road and Shurie Road*	9.9	EBLTR	B	10.4	0.39	13	-
		WBLTR	A	9.9	0.31	9	-
		NBLTR	A	8.9	0.16	4	-
		SBLTR	A	8.9	0.01	0	-
Townline Road and Alma Drive	1.6	WBLT	A	0.5	0.01	0	-
		NBLR	B	11.3	0.12	3	-
St Catharines Street (Regional Road 20) & Industrial Park Road	4.1	SBL	D	25.1	0.37	13	20
		SBR	B	12.5	0.20	6	-
		EBL	A	9.5	0.11	3	100
Street B	1.3	WBLT	A	0.2	0.01	0	-
		NBLR	B	11.7	0.10	2	-
Townline Road and Rock Street	1.7	EBLTR	A	0.1	0.00	0	-
		WBLTR	A	0.5	0.01	0	-
		NBLTR	B	11.2	0.09	2	-
		SBLTR	B	11.9	0.04	1	-
Street D	1.7	WBLR	A	9.8	0.07	2	-
		SBLT	A	1.0	0.01	0	-
Street F	1.9	WBLR	A	9.4	0.06	2	-
		SBLT	A	1.1	0.01	0	-
Unnamed Street South	2.3	WBLR	A	9.1	0.06	2	-
		SBLT	A	1.2	0.01	0	-
Townline Road and Sterling Street	1.7	EBLTR	A	0.1	0.00	0	-
		WBLTR	A	0.2	0.01	0	-
		NBLTR	B	12.7	0.11	3	-
		SBLTR	B	12.0	0.04	1	
PM Peak Period							

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Townline Road and Port Davidson Road	6.4	WBLT	A	5.8	0.23	7	-
		NBLR	C	17.3	0.43	16	-
Townline Road and Canborough Street*	20.8	EBLT	C	24.8	0.75	46	-
		WBTR	C	15.4	0.53	21	-
		SBLR	C	20.8	0.69	37	-
Townline Road and Shurie Road*	11.5	EBLTR	B	11.4	0.45	16	-
		WBLTR	B	12.1	0.49	19	-
		NBLTR	A	9.5	0.15	4	-
		SBLTR	A	9.0	0.03	0	-
Townline Road and Alma Drive	1.8	WBLT	A	1.7	0.05	1	-
		NBLR	B	12.9	0.10	3	-
St Catharines Street (Regional Road 20) & Industrial Park Road	108.7	SBL	F	572.4	2.12	207	20
		SBR	B	12.7	0.32	10	-
		EBL	A	9.4	0.17	5	100
Street B	1.0	WBLT	A	0.7	0.02	1	-
		NBLR	B	13.4	0.08	2	-
Townline Road and Rock Street	2.2	EBLTR	A	0.9	0.03	1	-
		WBLTR	A	1.1	0.03	1	-
		NBLTR	B	13.5	0.08	2	-
		SBLTR	B	14.9	0.09	2	-
Street D	1.7	WBLR	A	9.6	0.05	1	-
		SBLT	A	1.7	0.04	1	-
Street F	1.9	WBLR	A	9.4	0.04	1	-
		SBLT	A	1.9	0.04	1	-
Unnamed Street South	2.3	WBLR	A	9.1	0.04	1	-
		SBLT	A	2.3	0.04	1	-
Townline Road and Sterling Street	2.1	EBLTR	A	0.9	0.03	1	-
		WBLTR	A	0.7	0.02	1	-
		NBLTR	C	15.5	0.10	2	-
		SBLTR	B	14.2	0.08	2	-

* V/C ratio and 95th percentile queue are displayed based on HCM 6th Edition results for these intersections. 95th percentile queue was converted from vehicles to metres at 7 metres per vehicle.
** For the intersection of St Catharine Street and Industrial Park Road, St Catharines Street is considered an east-west roadway, and Industrial Park Road is considered a north-south roadway.

Table 5.5: ICA Results (Future Background Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (veh)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	A	9	WB	B	11	0.41	2	-
			SB	A	7	0.33	1	
			EB	A	9	0.40	2	
			NB	B	10	0.52	3	-
PM Peak Hour								
Townline Road and St Catharines Street	B	16	WB	A	8	0.24	1	-
			SB	C	22	0.84	12	
			EB	B	13	0.49	3	
			NB	B	12	0.59	4	-

Table 5.6: ICA Results (Future Background Scenario, Mitigated Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	A	4.1	SBL	D	25.1	0.37	13	20
			SBR	B	12.5	0.20	6	-
			EBL	A	9.5	0.11	3	100
After Mitigation								
St Catharines St & Industrial Park Rd	A	9.3	SBL	B	12	0.18	14.2	60
			SBR	A	3.9	0.21	7.7	
			WBT	B	13.5	0.57	49.5	
			WBR	A	2.6	0.34	9.3	
			EBL	B	11.5	0.30	13.3	100
			EBT	A	9.8	0.31	24.3	
PM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	A	108.7	SBL	F	572.4	2.12	207	30
			SBR	B	12.7	0.32	10	-
			EBL	A	9.4	0.17	5	100
After Mitigation								
St Catharines St & Industrial Park Rd	B	11.5	SBL	B	16.5	0.54	42.5	60
			SBR	A	3.4	0.3	10	
			WBT	B	11.1	0.43	36.6	
			WBR	A	2.5	0.26	7.9	
			EBL	B	12.7	0.40	21.0	100
			EBT	B	14.9	0.65	60.9	

** For the intersection of St Catharine Street and Industrial Park Road, St Catharines Street is considered an east-west roadway, and Industrial Park Road is considered a north-south roadway.

5.4 FUTURE TOTAL SCENARIO (2030)

In the future total scenario, both the estimated future background traffic volumes in **Section 5.3** and the trips generated by the Phase 1 development in **Section 4.1** are considered.

No adjustment to the future background road configuration and intersection control is applied in this scenario.

5.4.1 Traffic Volume

The traffic volume distribution for the future total scenario was generated for the AM and PM peak hours in the 2030 study horizon year. The forecasted traffic volume is illustrated in **Figure 5-6** and **Figure 5-7** for the weekday AM and PM peak hours**.**

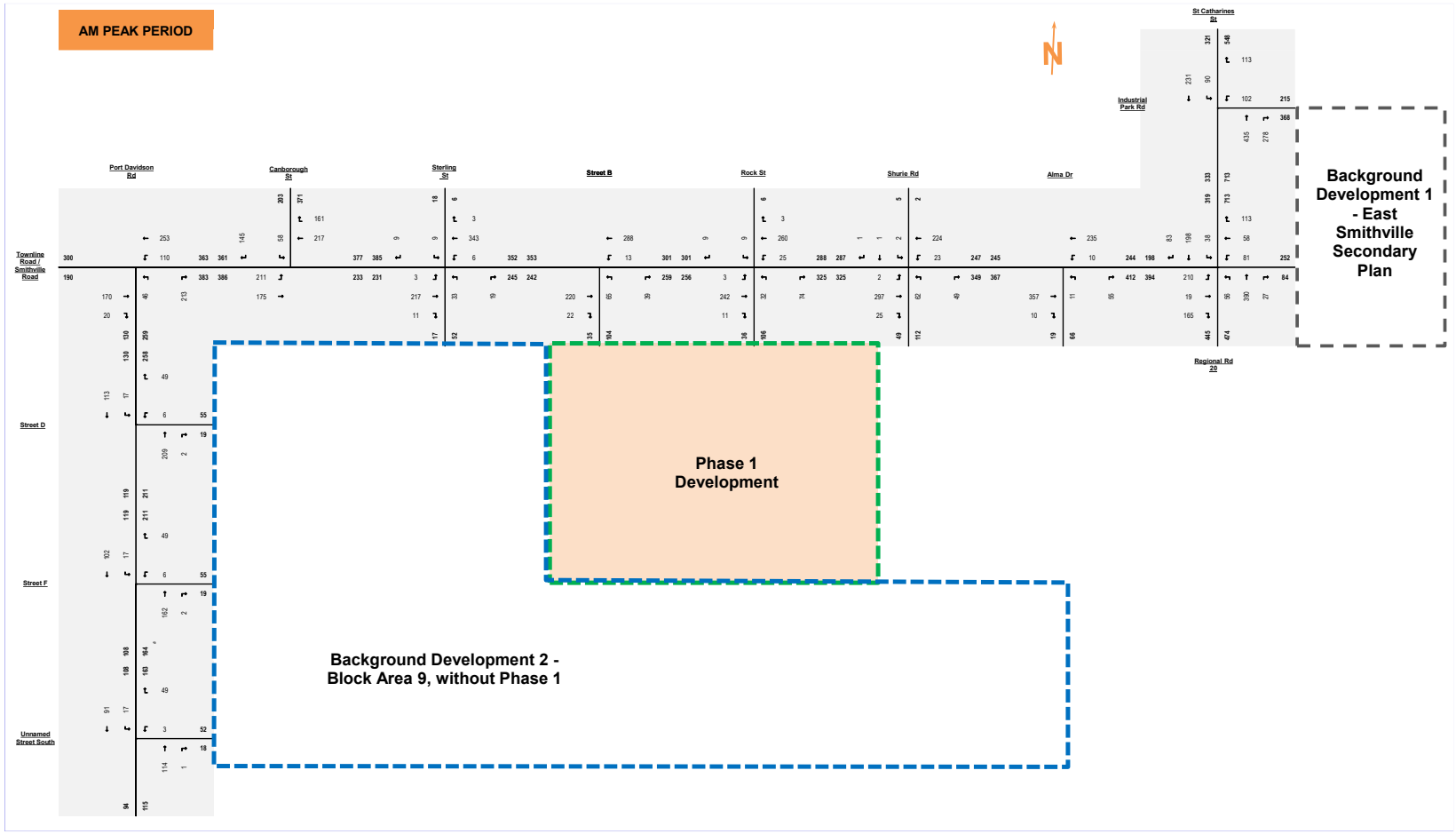


Figure 5-6: Future Total Scenario (2030) – Weekday AM Peak Hour Traffic Volumes

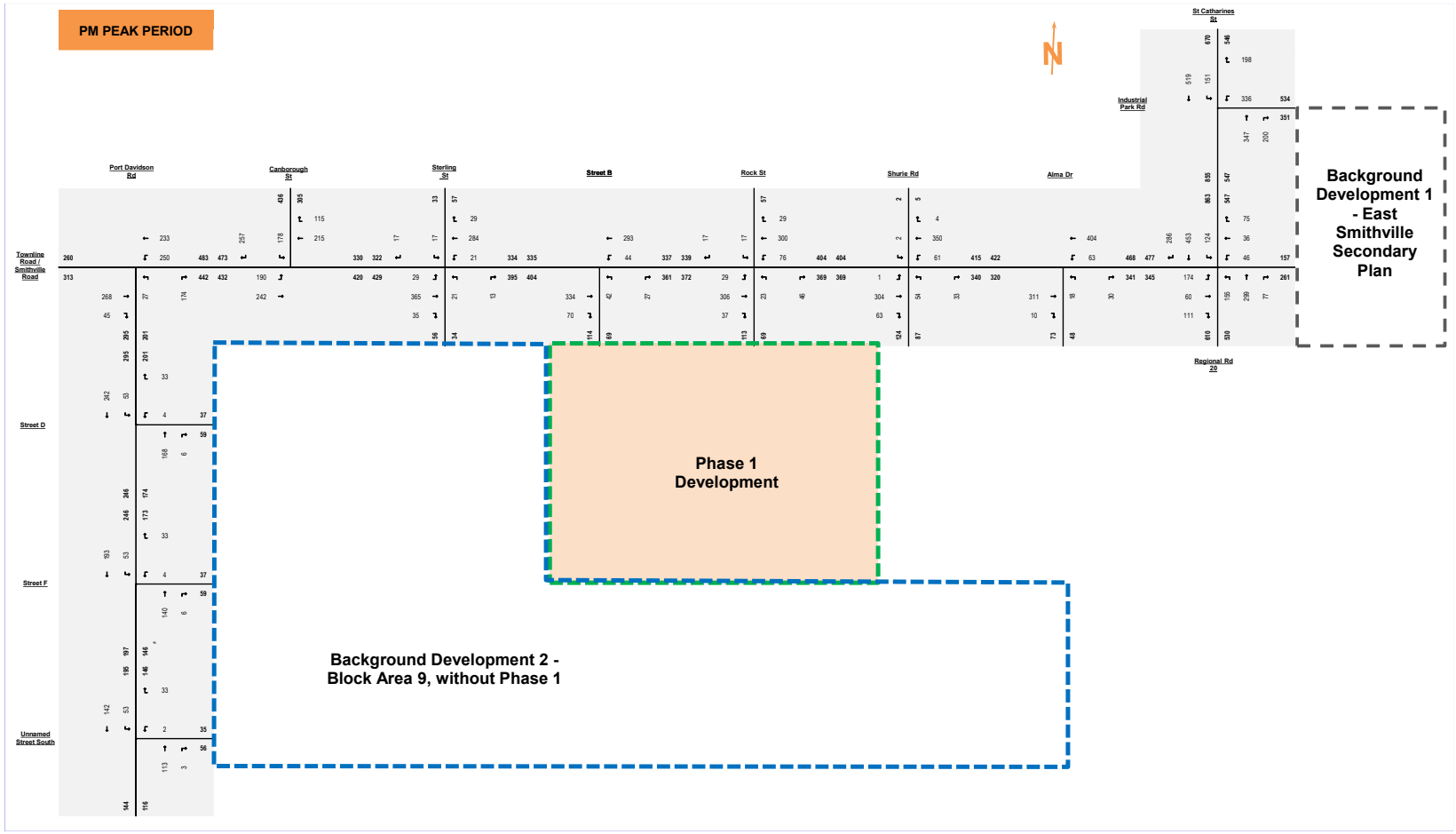


Figure 5-7: Future Total Scenario (2030) – Weekday PM Peak Hour Traffic Volumes

5.4.2 Traffic Operations Analysis

The results of the HCM intersection capacity analysis (ICA) of the future total scenario for the study area intersections are presented in **Table 5.7** and **Table 5.8.** Synchro outputs for this scenario are included in **Appendix I.** ARCADY outputs for this scenario are included in **Appendix J**.

All intersections in the study area, except for the Townline Road and Canborough Street, St Catharines Street and Townline Road, and St Catharines Street and Industrial Park Road intersections, are anticipated to operate within capacity with each movement performing at LOS C or better during both the AM and PM peak hours.

Townline Road and Canborough Street: In this scenario, it is noted that the southbound and eastbound movements at the Townline Road and Canborough Street intersection performs at LOS D and E respectively during the PM peak hour. However, no mitigation strategy is recommended to this intersection based on the following factors:

- Intersection delay and capacity calculations in Synchro are based on conservative assumptions on driver behavior, e.g. strict gap acceptance and uniformly distributed vehicle arrival for unsignalized intersections.
- Intersection delay of 30 seconds is considered acceptable in an urban intersection.

It is recommended that traffic conditions at this intersection be monitored.

St Catharines Street and Townline Road: In this scenario, it is noted that the southbound movement at the Townline Road and St Catharines Street roundabout performs at LOS D during the PM peak hour. However, no mitigation strategy is recommended to this intersection based on the following factors:

- An approach delay of 29 seconds and 95th percentile queue of 13 vehicles are considered acceptable in an urban intersection and does not interfere with upstream operations of the roadway.
- Majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area, as indicated in **Figure 4.7** and **Figure 4.8**. However, the available traffic information for the East Smithville Secondary Plan Area is limited, and the scale of development and the distribution of these trips are based on high-level assumptions. These assumptions are expected to be modified with future development plans.

It is recommended that further traffic analysis to be conducted as part of the proposed development applications in the area to better assess the potential traffic impacts at this roundabout.

St Catharines Street and Industrial Park Road: In this scenario, it is noted that the southbound left movement at the St Catharines Street and Industrial Park Road intersection performs at LOS D during the AM peak hour and LOS F during the PM peak hour. The 95th percentile queue of the southbound left movement also exceeds the storage length of the movement in the PM peak hour. In addition, projected traffic volumes in the future total scenario meets traffic signal warrant thresholds, as indicated in **Appendix K**.

Similar to the future background scenario, based on the available information, traffic signal is recommended at the St Catharines Street and Industrial Park Road intersection to mitigate the critical operations. The storage length of the southbound left movement is also recommended to be extended to 60 metres.

The ICA results of the mitigation scenario and pre-mitigation scenario at this intersection are presented in **Table 5.9.**

As noted under the future background scenario, the majority of the increased traffic demand through this intersection is due to the assumed background development from the East Smithville Secondary Plan Area. Given that the available traffic information for the East Smithville Secondary Plan Area is limited, and that the scale of development and the distribution of these trips are based on high-level assumptions, the current assumptions are recommended to be further studies as part of the future development applications. Therefore, it is recommended that further traffic analysis be conducted by proposed development applications in the area to better assess the potential traffic impacts and review the need for traffic signalization at this intersection.

Table 5.7: ICA Results (Future Total Scenario, Stop-Controlled Intersections)

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
AM Peak Period							
Townline Road and Port Davidson Road	5.9	WBLT	A	3.1	0.09	2	-
		NBLR	B	14.2	0.42	16	-
Townline Road and Canborough Street*	15.3	EBLT	C	17.6	0.62	30	-
		WBTR	B	15.0	0.58	26	-
		SBLR	B	11.7	0.34	11	-
	11.0	EBLTR	B	11.9	0.53	22	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Townline Road and Shurie Road*		WBLTR	B	10.6	0.37	12	-
		NBLTR	A	9.5	0.18	5	-
		SBLTR	A	9.0	0.01	0	-
Townline Road and Alma Drive	1.3	WBLT	A	0.4	0.01	0	-
		NBLR	B	12.1	0.12	3	-
St Catharines Street (Regional Road 20) & Industrial Park Road	4.3	SBL	D	29.4	0.43	16	20
		SBR	B	13.2	0.22	6	-
		EBL	A	10.0	0.12	3	100
Street B	2.3	WBLT	A	0.4	0.01	0	-
		NBLR	B	13.3	0.21	6	-
Townline Road and Rock Street	2.8	EBLTR	A	0.1	0.00	0	-
		WBLTR	A	0.9	0.02	1	-
		NBLTR	B	12.6	0.19	5	-
		SBLTR	B	13.5	0.05	1	-
Street D	1.7	WBLR	A	10.0	0.08	2	-
		SBLT	A	1.1	0.01	0	-
Street F	2.0	WBLR	A	9.6	0.07	2	-
		SBLT	A	1.2	0.01	0	-
Unnamed Street South	2.2	WBLR	A	9.2	0.06	2	-
		SBLT	A	1.2	0.01	0	-
Townline Road and Sterling Street	1.6	EBLTR	A	0.1	0.00	0	-
		WBLTR	A	0.2	0.01	0	-
		NBLTR	B	13.8	0.12	3	-
		SBLTR	B	12.9	0.04	1	-
PM Peak Period							
Townline Road and Port Davidson Road	6.4	WBLT	A	5.9	0.23	7	-
		NBLR	C	17.6	0.44	17	-
Townline Road and Canborough Street*	30.3	EBLT	E	37.5	0.83	60	-
		WBTR	C	20.4	0.63	31	-
		SBLR	D	30.8	0.79	55	-
Townline Road and Shurie Road*	14.0	EBLTR	B	13.5	0.61	29	-
		WBLTR	C	15.3	0.62	30	-
		NBLTR	A	10.0	0.16	4	-
		SBLTR	A	9.4	0.00	0	-

Intersection	Intersection Delay (s)	Traffic Operations Results by Movement					
		Movements	LOS	Lane Delay (s)	Lane V/C Ratio	Lane 95th Percentile Queue (m)	Lane Storage Capacity (m)
Townline Road and Alma Drive	1.8	WBLT	A	1.7	0.06	1	-
		NBLR	B	14.9	0.13	3	-
St Catharines Street (Regional Road 20) & Industrial Park Road	141.7	SBL	F	726.4	2.46	239	20
		SBR	B	13.5	0.34	11	-
		EBL	A	9.5	0.17	5	100
Street B	2.0	WBLT	A	1.5	0.04	1	-
		NBLR	C	15.8	0.18	5	-
Townline Road and Rock Street	2.6	EBLTR	A	0.9	0.03	1	-
		WBLTR	A	2.2	0.07	2	-
		NBLTR	C	16.0	0.19	5	-
		SBLTR	C	18.2	0.12	3	-
Street D	1.7	WBLR	A	9.8	0.05	1	-
		SBLT	A	1.7	0.04	1	-
Street F	1.9	WBLR	A	9.5	0.05	1	-
		SBLT	A	1.9	0.04	1	-
Unnamed Street South	2.2	WBLR	A	9.2	0.04	1	-
		SBLT	A	2.3	0.04	1	-
Townline Road and Sterling Street	1.3	EBLTR	A	0.8	0.03	1	-
		WBLTR	A	0.7	0.02	1	-
		NBLTR	C	17.2	0.11	3	-
		SBLTR	C	15.5	0.09	2	-

* V/C ratio and 95th percentile queue are displayed based on HCM 6th Edition results for these intersections. 95th percentile queue was converted from vehicles to metres at 7 metres per vehicle.

** For the intersection of St Catharine Street and Industrial Park Road, St Catharines Street is considered an east-west roadway, and Industrial Park Road is considered a north-south roadway.

Table 5.8: ICA Results (Future Total Scenario, Roundabout Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	Lane LOS	Lane Delay (s)	V/C Ratio	Lane 95th Percentile Queue (veh)	Storage Capacity (m)
AM Peak Hour								
Townline Road and St Catharines Street	B	10	WB	B	12	0.44	2	-
			SB	A	7	0.34	2	
			EB	A	10	0.47	3	
			NB	B	11	0.55	3	-
PM Peak Hour								
Townline Road and St Catharines Street	B	20	WB	A	8	0.25	1	-
			SB	D	29	0.90	13	
			EB	B	14	0.55	3	
			NB	B	14	0.63	5	-

Table 5.9: ICA Results (Future Total Scenario, Mitigated Intersection)

Intersection	Intersection LOS	Intersection Delay	Traffic Operations Results by Movements					
			Movement	LOS	Delay (s)	V/C Ratio	95th Percentile Queue (m)	Storage Capacity (m)
AM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	A	4.3	SBL	D	29.4	0.43	16	20
			SBR	B	13.2	0.22	6	-
			EBL	A	10.0	0.12	3	100
After Mitigation								
St Catharines St & Industrial Park Rd	A	9.5	SBL	B	12.1	0.19	14.8	60
			SBR	A	3.9	0.21	7.7	
			WBT	B	14.1	0.60	52.3	
			WBR	A	2.7	0.36	9.6	
			EBL	B	11.9	0.31	13.6	100
			EBT	A	9.9	0.31	24.9	
PM Peak Hour								
Before Mitigation								
St Catherines St & Industrial Park Rd	F	141.7	SBL	F	726.4	2.46	239	30
			SBR	B	13.5	0.34	11	-
			EBL	A	9.5	0.17	5	100
After Mitigation								
St Catharines St & Industrial Park Rd	B	13.1	SBL	B	17.6	0.60	46.7	60
			SBR	A	3.7	0.33	10.0	
			WBT	B	12.4	0.49	40.1	
			WBR	A	2.6	0.28	8.4	
			EBL	B	13.9	0.43	22.2	100
			EBT	B	18.0	0.72	71.5	

** For the intersection of St Catharine Street and Industrial Park Road, St Catharines Street is considered an east-west roadway, and Industrial Park Road is considered a north-south roadway.

6.0 TRANSPORTATION DEMAND MANAGEMENT

Some potential TDM strategies and measures could be deployed to reduce site generated single-occupant vehicle trips, which will mitigate the roadway/intersection capacity issues in the future. A summary of the TDM-supportive side design elements, infrastructure, and recommendations are shown below:

- TDM Education:
    - Providing program incentives and initiatives to promote TDM such as sharing TDM options and raising TDM awareness, TDM website and brochures.
- Carpooling:
    - Promoting the Niagara Rideshare carpool matching tool to future residents.
- Active Transportation:
    - Providing cycling infrastructure such as bike lanes and shared-use paths on local and regional roads throughout the site.
    - Providing pedestrian facilities such as sidewalks and shared-use paths on both sides of all roads throughout the site.
    - Providing bike parking/repairing facilities in the area.
    - Supporting school-based programs with options for active transportation to school.
- Travel Planning:
    - Promoting the Niagara Region Map App and cycling maps to site residents.

7.0 SITE ACCESS SIGHTLINE REVIEW

A desktop review was performed by utilizing Google's aerial and street view imagery to identify sightline deficiencies in the vicinity of the proposed site access locations. **Figure 7-1** shows the nine proposed site accesses. It is of note that the accesses numbered 7, 8, and 9 will not be evaluated in this section as they are not intersections.

Using equation **9.9.1** of the Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads, Chapter 9 – Intersections*, the following was used to calculate intersection sight distance (ISD):

$$ISD = 0.278\, V_{Major} t_g$$

Where:

ISD is the required intersection sight distance in metres;

V_{Major} is the major roadway's design speed in km/h; and

t_g is the minor roadway time gap in seconds.

The intersection sight distance was calculated using the following parameters:

- 60 km/h design speed for Townline Road and 90km/h[1] for Port Davidson Road;
- A time gap of 9.5 seconds for left turns from a stop and 8.5 seconds for right turns from a stop was utilized to represent a single-unit truck (e.g. garbage truck, fire truck) attempting to perform a turning maneuver from the site access; and,
- A time gap of 6.5 seconds for left turns from Townline Road and Port Davidson Road into the site access.

The calculations results are summarized in **Table 7.1**. Based on TAC Geometric Design Guide for Canadian Roads ("TAC") Section 9.9.2.3, the applicable cases are as follows:

- Case B1 – left turn movement from the minor road
- Case B2 – right turn movement from the minor road
- Case F – left turn movement from the major road

[1] Posted speed limit for Port Davidson Road is expected to be reduced to 50 km/h when the Block Plan fully built out. For a conservative analysis, a design speed of 90 km/h (posted speed of 80 km/h, plus 10 km/h) is used.

In addition to intersection sight distance requirements, stopping sight distances (SSD) were also evaluated to determine whether approaching vehicles along the major roadways have sufficient sight distance to perceive a conflict and decelerate to a stop in order to avoid a collision. Stopping sight distance is the sum of the distance travelled during the perception and reaction time, and the braking distance. To determine the minimum stopping sight distance relative to the design speed, *TAC* **Table 2.5.2** is used.

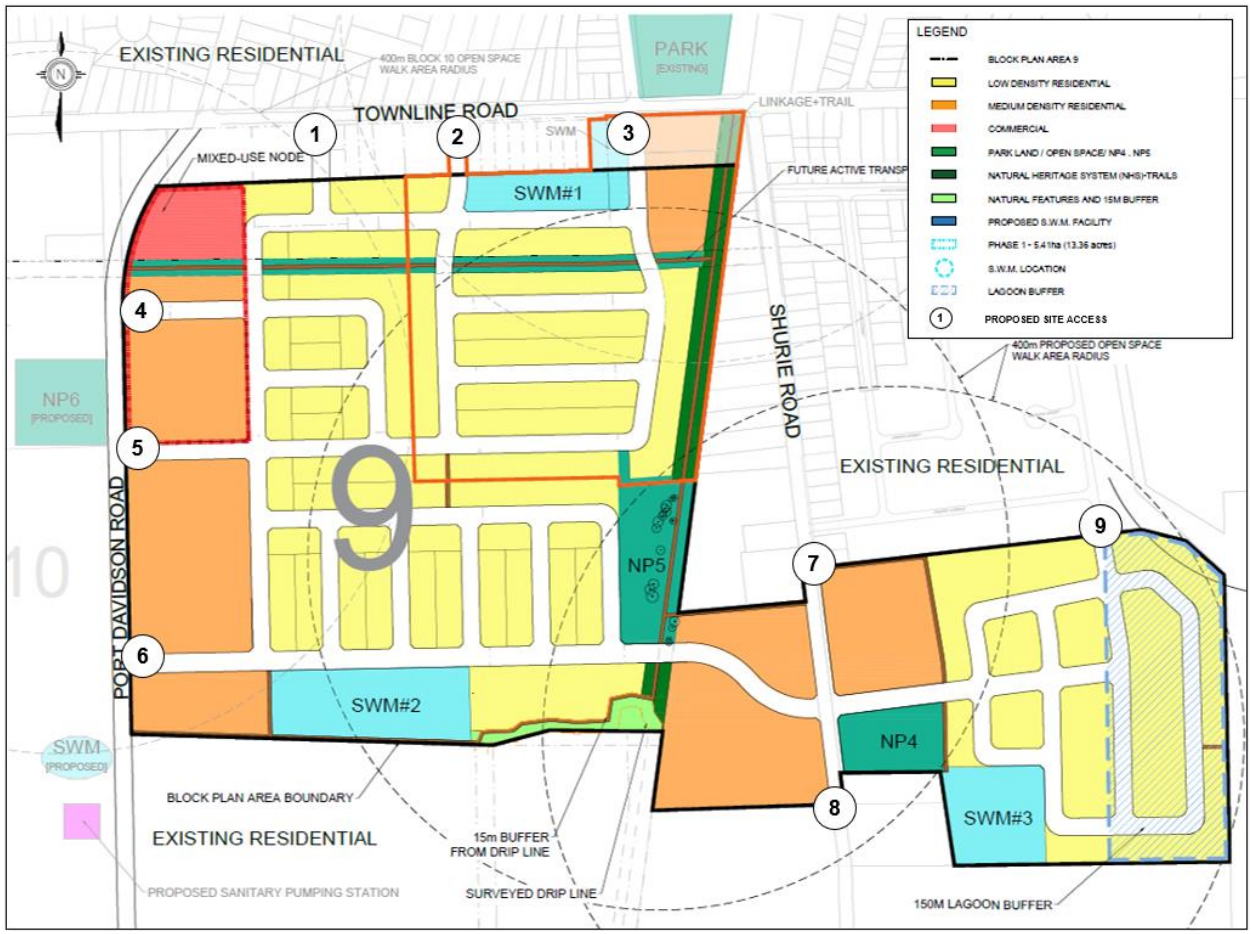


Figure 7-1: Proposed Site Access Locations

Table 7.1: ISD calculation results for combination trucks

Access Number	Intersection	Case	Design Speed (km/h)	Stopping Sight Distance (m)	Required Intersection Sight Distance (m)	Available Sight Distance (m)
1	Townline Road and Sterling Street (stop signs on the minor road)	B1	60	85	160	>200
		B2	60	85	140	>200
		F	60	85	110	>200
2	Townline Road and Street B (stop sign on the minor road)	B1	60	85	160	>200
		B2	60	85	140	>200
		F	60	85	110	>200
3	Townline Road and Street A / Rock Street (stop signs on the minor road)	B1	60	85	160	>200
		B2	60	85	140	>200
		F	60	85	110	>200
4	Port Davidson Road and Street D (stop sign on the minor road)	B1	90	130	240	190
		B2	90	130	215	>250
		F	90	130	160	>200
5	Port Davidson Road and Street F (stop sign on the minor road)	B1	90	130	240	>250
		B2	90	130	215	>250
		F	90	130	160	>200
6	Port Davidson Road and Unnamed Street South (stop sign on the minor road)	B1	90	130	240	>250
		B2	90	130	215	>250
		F	90	130	160	>200

Figure 7-2 to **Figure 7-7** shows the required ISDs per case for each proposed access.

According to the existing aerial map, the sight distances in the north and south directions from the proposed accesses at Port Davidson Road, and the sight distances in the east and west directions from the proposed accesses at Townline Road are expected to exceed the required distances, except for the Case B1 (left-turn movement from a minor road) of Access 4 along Port Davidson Road.

The available sight distance for Case B1 (left-turn movement from a minor road) of Access 4 along Port Davidson Road is 190 metres, which is less than the required calculated ISD of 240 metres. It should be noted however, that vehicles travelling southbound along Port Davidson Road are accelerating from a left or right turn from Townline Road and are therefore anticipated to travel well below the roadway's design speed of 90 km/hr just south of Townline Road. Given this condition, there will be sufficient sight distance for the left-turning vehicles to complete their turn out of Access 4.

In addition, no vertical profile sight constraint was observed at the proposed site accesses. Therefore, the proposed site accesses are expected to have adequate sight distance.

Figure 7-2: Intersection Sight Distance Requirements for Proposed Access 1

Figure 7-3: Intersection Sight Distance Requirements for Proposed Access 2

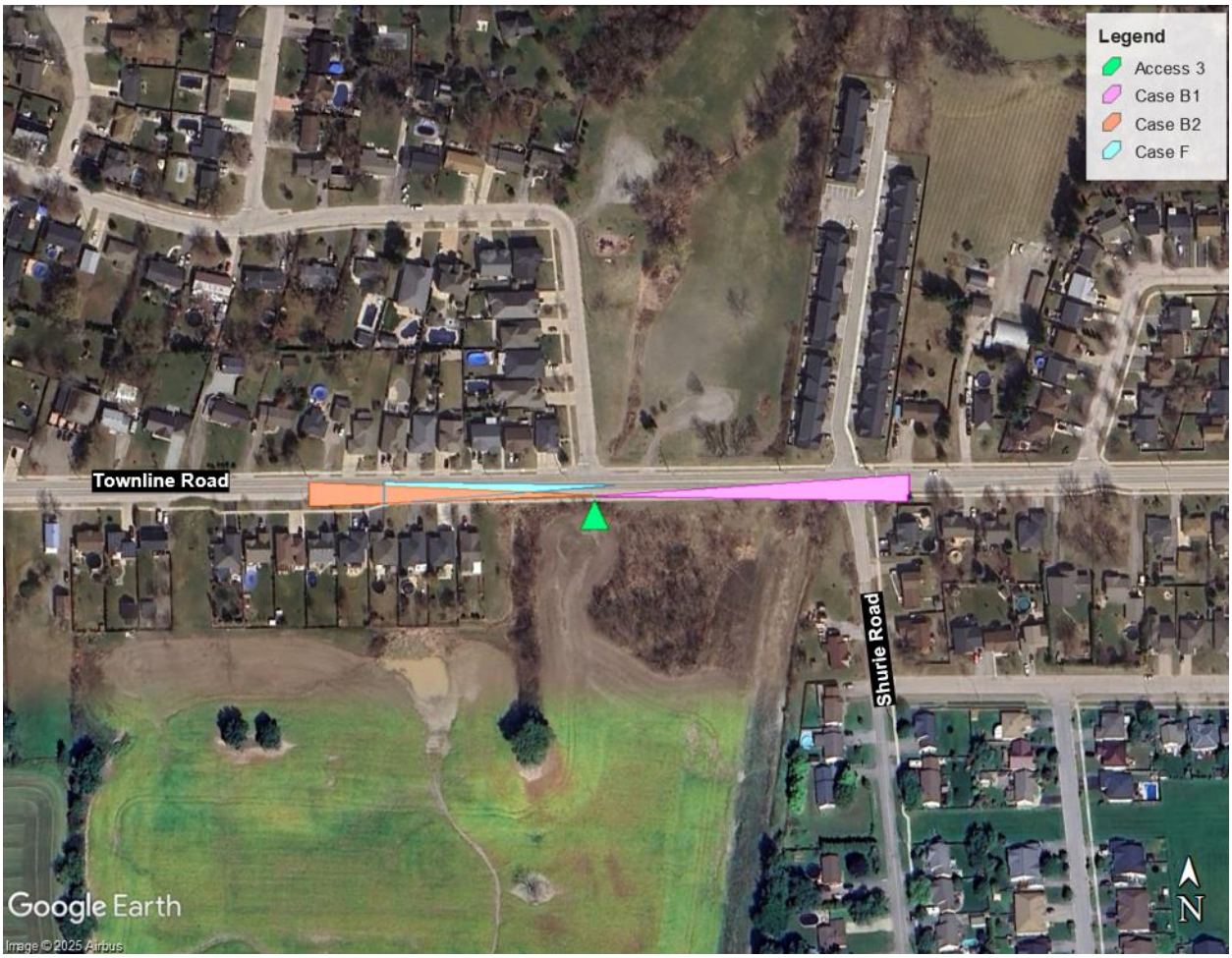


Figure 7-4: Intersection Sight Distance Requirements for Proposed Access 3

Figure 7-5: Intersection Sight Distance Requirements for Proposed Access 4

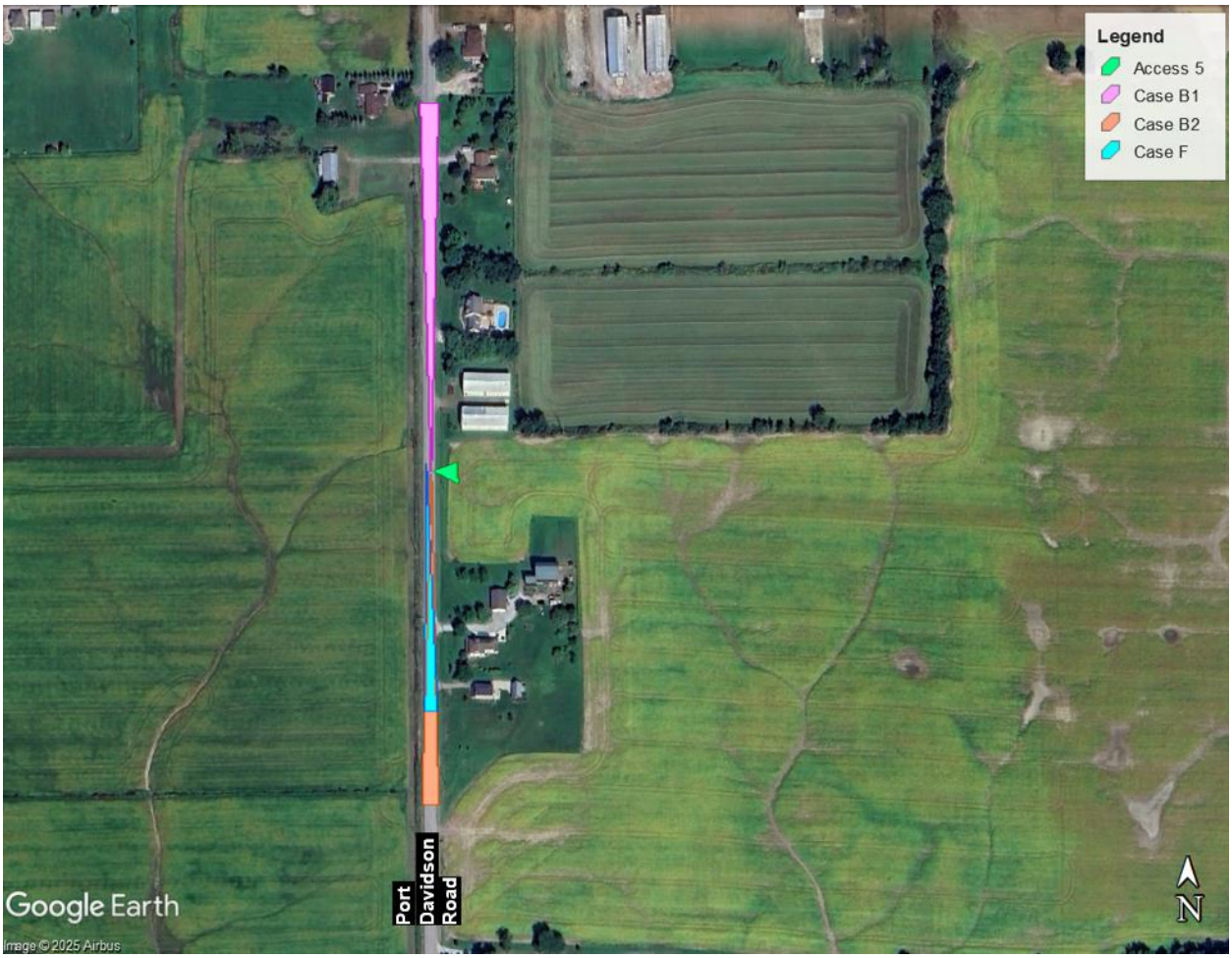


Figure 7-6: Intersection Sight Distance Requirements for Proposed Access 5

Figure 7-7: Intersection Sight Distance Requirements for Proposed Access 6

8.0 CONCLUSIONS & RECOMMENDATIONS

A TIS report was initially submitted in August 2024 based on an outdated site plan. This updated traffic impact study based on an updated site plan for the proposed Block Plan Area 9 development concludes:

- 37 inbound and 111 outbound trips in the AM peak hour, and 122 inbound and 74 outbound trips in the PM peak hour are expected to be generated by the proposed Phase 1 Development based on the *ITE Trip Generation Manual, 11th Edition*.
- 119 inbound and 355 outbound trips in the AM peak hour, and 391 inbound and 235 outbound trips in the PM peak hour are expected to be generated by the proposed East Smithville Secondary Plan development; 122 inbound and 365 outbound trips in the AM peak hour, and 389 inbound and 240 outbound trips in the PM peak hour are expected to be generated by the proposed Block Plan Area 9 without Phase 1 development. The trips from these two developments are added to the 2030 background traffic.
- The study area intersections are currently performing with LOS B or better under the 2024 existing condition except for the southbound left-turn movement at the St Catharines Street and Industrial Park Road intersection which performs LOS D during PM peak hour.
- Most study area intersection movements are expected to perform with LOS C or better under the 2030 Background Development and 2030 Total Development scenarios, with the following exceptions:
    - Eastbound movement at the Townline Road and Canborough Street intersection, which performs at LOS E in the 2030 Total Development scenario during the PM peak hour.
    - Southbound movement at the St Catharines Street and Townline Road intersection, which performs at LOS D during the PM peak hour.
    - Southbound left-turn movement at the St Catharines Street and Industrial Park Road intersection, which performs at LOS D and LOS F during the AM and PM peak hours, respectively. Traffic signalization and extension of southbound left turn storage length to 60 metres are recommended as mitigations for both 2030 Background Development and 2030 Total Development scenarios.
- When considering potential mitigation strategy, a few factors were considered, including limited information available for the East Smithville Secondary Plan

development, signal timing warrant results, and the conservative assumptions used in the analysis methodology. The following are recommended:

  - For the Townline Road and Canborough Street, and St Catharines Street and Townline Road intersections, it is recommended that future traffic volumes and impacts be monitored for potential need for intersection improvements.
  - For the St Catharines Street and Industrial Park Road intersection, traffic signalization and extension of southbound left turn storage length to 60 metres are recommended as mitigations for both the 2030 Background Development and 2030 Total Development scenarios.
  - For the St Catharines Street and Townline Road, and the St Catharines Street and Industrial Park Road intersections, it is recommended that further traffic analysis be conducted by proposed development applications in the area.

- No mitigation is recommended for the proposed Phase 1 development at the 2030 horizon.
- Transportation demand management (TDM) measures are recommended to help mitigate roadway capacity issues and encourage the use of sustainable transportation modes.
- The sightlines for the six proposed site accesses are adequate according to the *TAC* intersection sight distance and stopping sight distance guidelines.
- Per Township of West Lincoln's *Official Plan Amendment (OPA) No. 63, Schedule 'L'*, and the *Smithville TMP*, the Town proposed a future realignment of Port Davidson Road to align with Canborough Street in its intersection with Townline Road to support development of the Urban Boundary Expansion Lands. At this time and per the conclusions noted above, it is found that the existing intersection configuration is sufficient for the projected demand of Block Plan Area 9 and a realignment is not needed to accommodate this projected demand. It is recommended that the needs and timing of the planned realignment to be reviewed by the Town and the Region as this and other future developments in the area progress.

APPENDIX A

Traffic Count Data

Townline Road & St Catharines Street

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

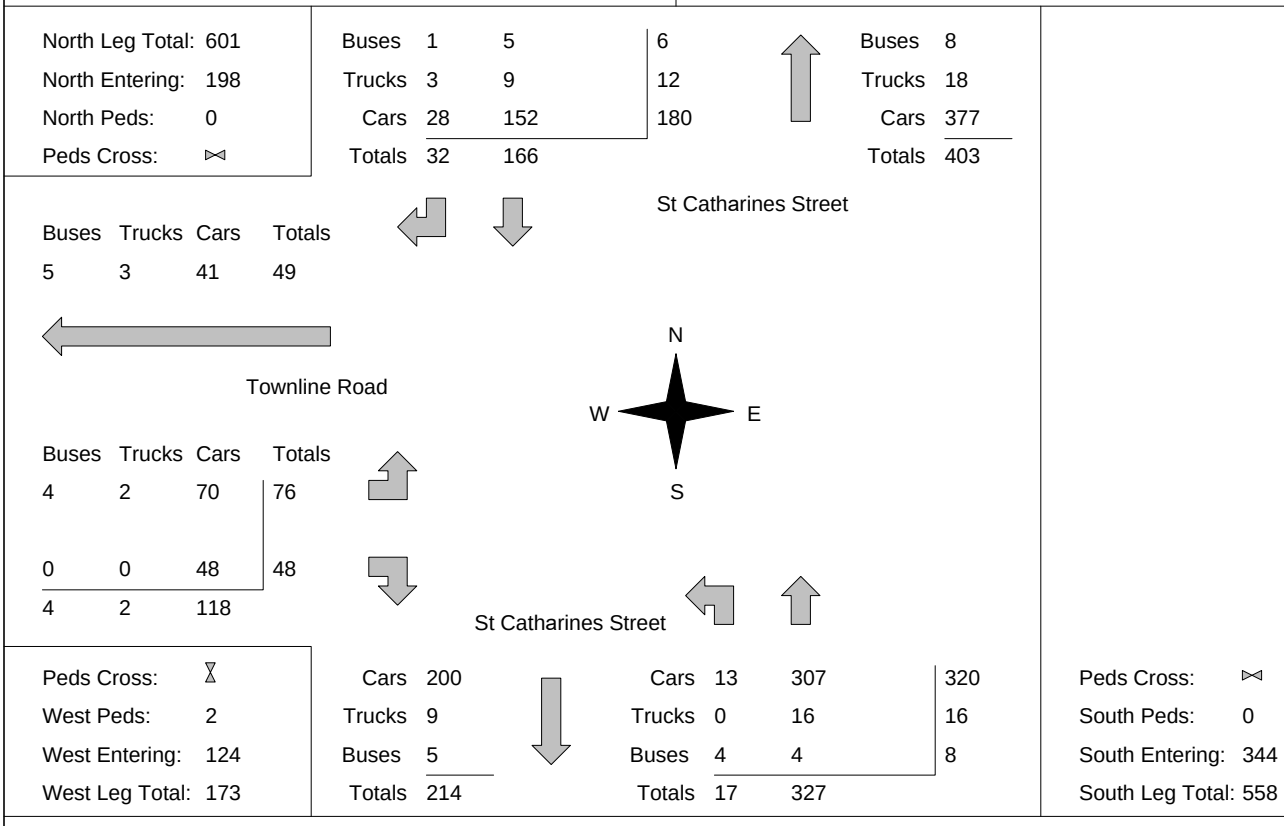
One Hour Peak
From: 7:00:00
To: 8:00:00

Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear
Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

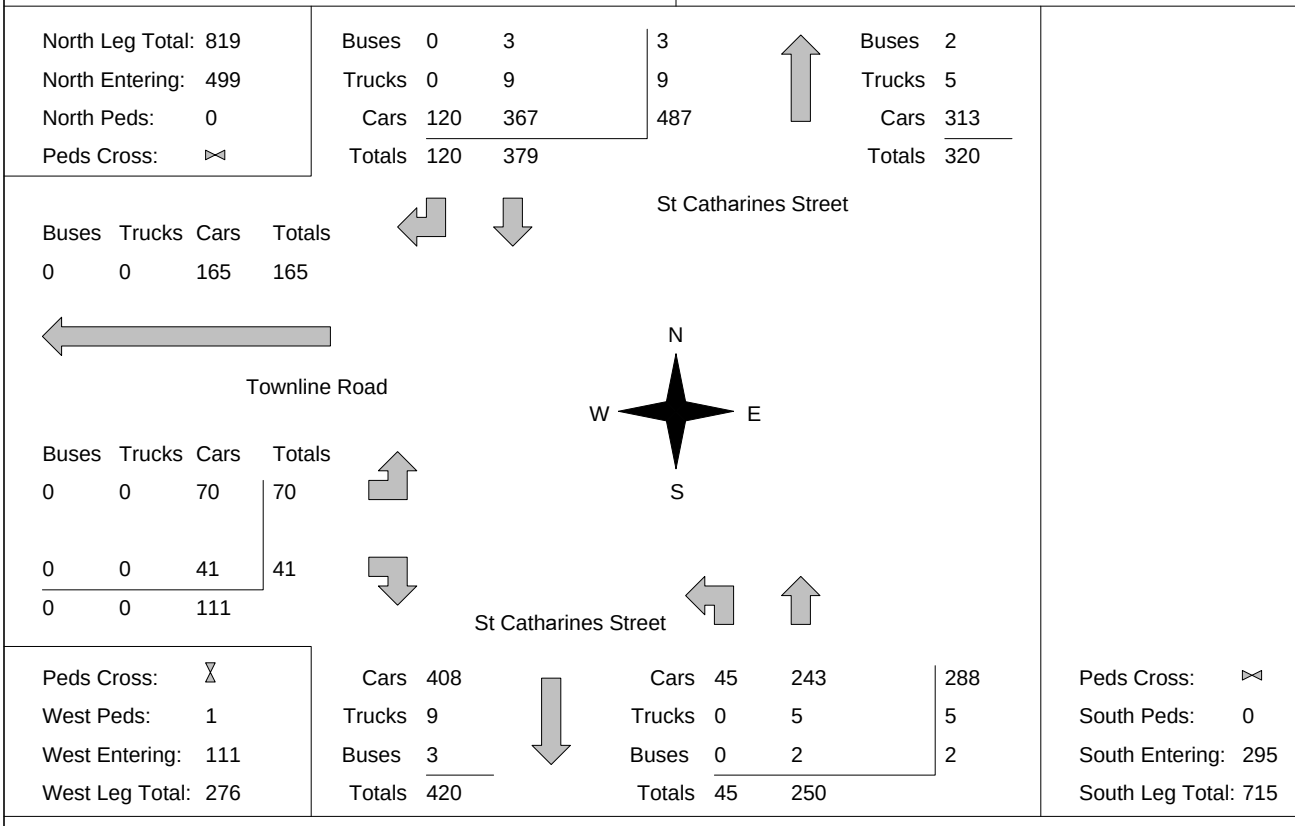
Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street

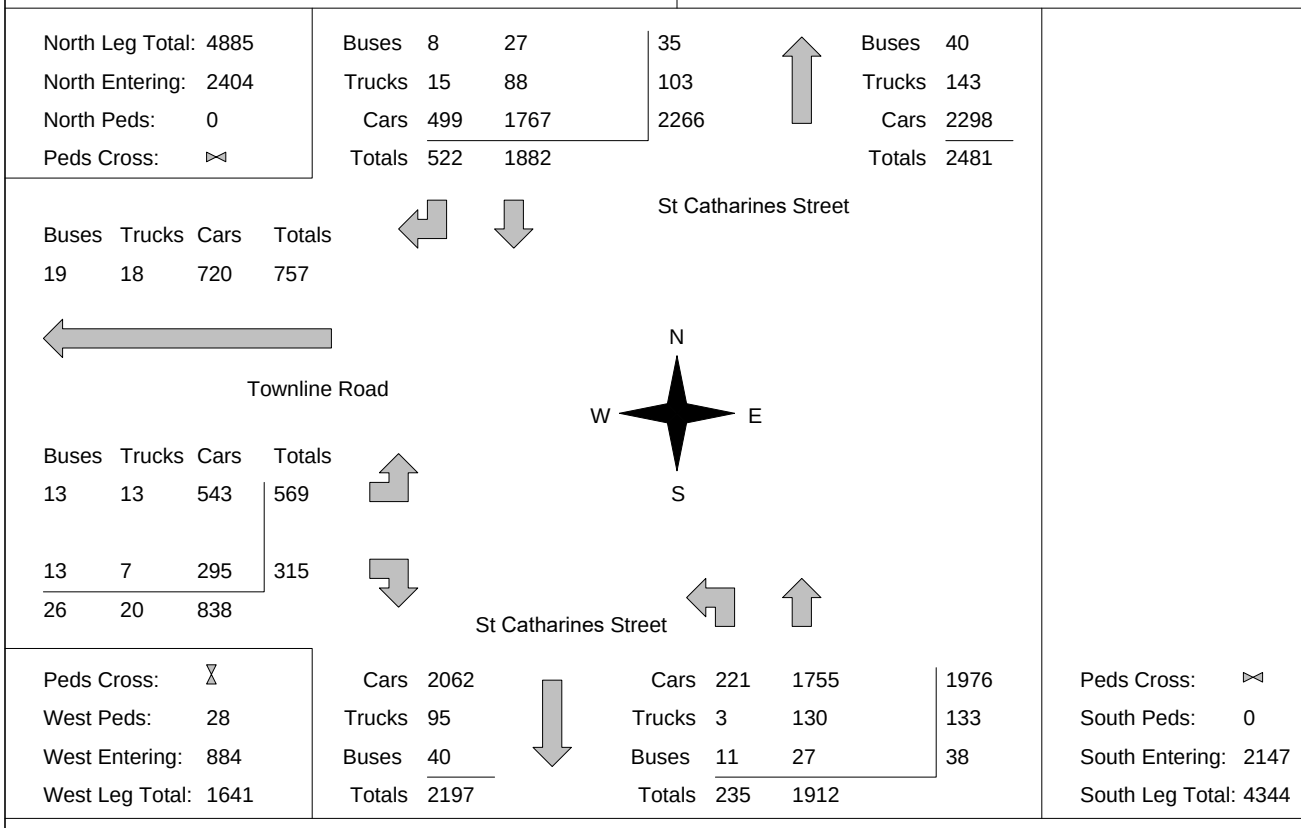
Total Count Diagram

Municipality: Smithville
Site #: 0000002301
Intersection: St Catharines Street & Townline Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear
Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: St Catharines Street runs N/S



Comments

ROUNDABOUT

Townline Road & St Catharines Street
Traffic Count Summary

Intersection: St Catharines Street & Townline Ro | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	58	16	74	0	226
8:00:00	0	166	32	198	0	542
9:00:00	0	160	44	204	0	476
10:00:00	0	167	38	205	0	460
15:00:00	0	215	60	275	0	513
16:00:00	0	308	88	396	0	641
17:00:00	0	383	118	501	0	776
18:00:00	0	316	83	399	0	676
Totals:	0	1773	479	2252	0	4310

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	2	150	0	152	0
8:00:00	17	327	0	344	0
9:00:00	40	232	0	272	0
10:00:00	20	235	0	255	0
15:00:00	24	214	0	238	0
16:00:00	35	210	0	245	0
17:00:00	41	234	0	275	0
18:00:00	47	230	0	277	0
Totals:	226	1832	0	2058	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	59
8:00:00	0	0	0	0	0	124
9:00:00	0	0	0	0	0	129
10:00:00	0	0	0	0	0	91
15:00:00	0	0	0	0	0	87
16:00:00	0	0	0	0	0	124
17:00:00	0	0	0	0	0	115
18:00:00	0	0	0	0	0	107
Totals:	0	0	0	0	0	836

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	43	0	16	59	3
8:00:00	76	0	48	124	2
9:00:00	87	0	42	129	3
10:00:00	60	0	31	91	8
15:00:00	57	0	30	87	3
16:00:00	75	0	49	124	2
17:00:00	76	0	39	115	1
18:00:00	66	0	41	107	3
Totals:	540	0	296	836	25

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	43	76	87	60	57	75	76	66

Townline Road & Canborough Street

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

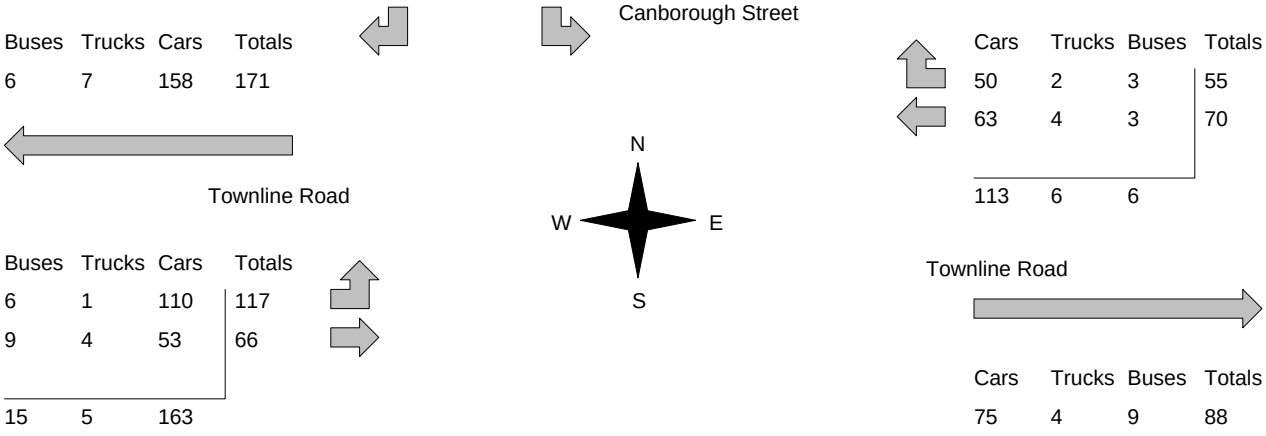
Major Road: Townline Road runs W/E

North Leg Total: 295
North Entering: 123
North Peds: 0
Peds Cross: ⋈

Buses	3	0	3
Trucks	3	0	3
Cars	95	22	117
Totals	101	22	

Buses	9
Trucks	3
Cars	160
Totals	172

East Leg Total: 213
East Entering: 125
East Peds: 6
Peds Cross: ⧖



Buses	Trucks	Cars	Totals
6	7	158	171

Cars	Trucks	Buses	Totals
50	2	3	55
63	4	3	70
113	6	6	

Buses	Trucks	Cars	Totals
6	1	110	117
9	4	53	66
15	5	163	

Cars	Trucks	Buses	Totals
75	4	9	88

Peds Cross: ⧖
West Peds: 0
West Entering: 183
West Leg Total: 354

Comments

Townline Road & Canborough Street

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

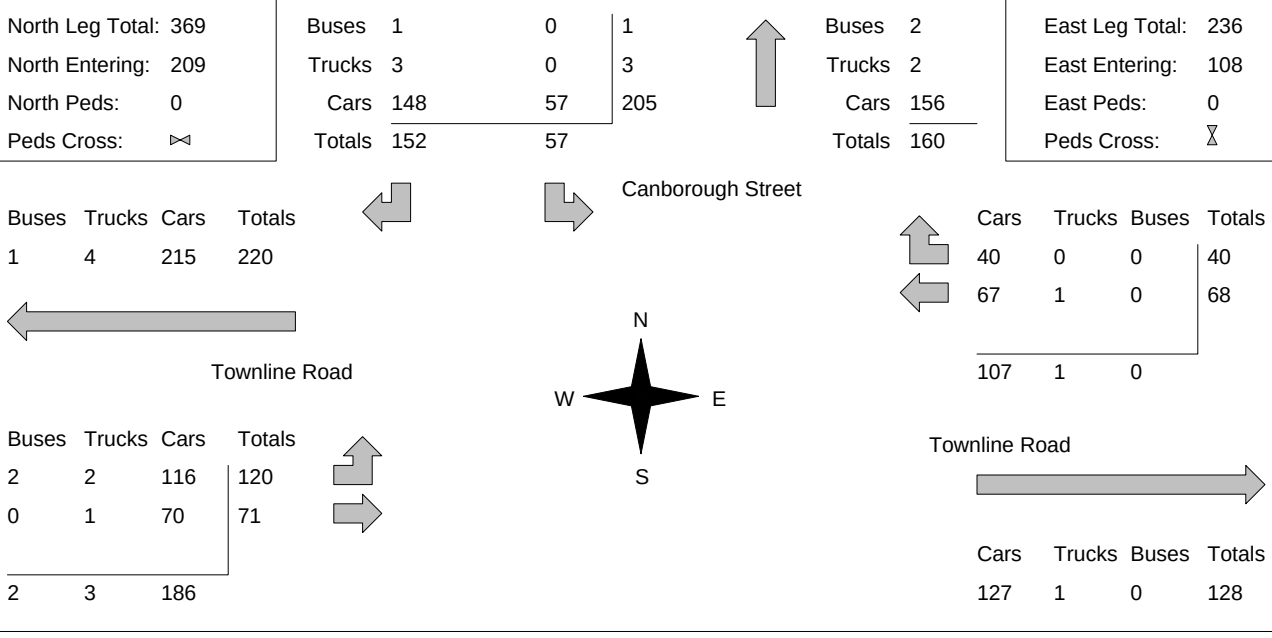
Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E



Peds Cross:
West Peds: 2
West Entering: 191
West Leg Total: 411

Comments

Townline Road & Canborough Street

Total Count Diagram

Municipality: Smithville
Site #: 0000002302
Intersection: Townline Road & Canborough Stree
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

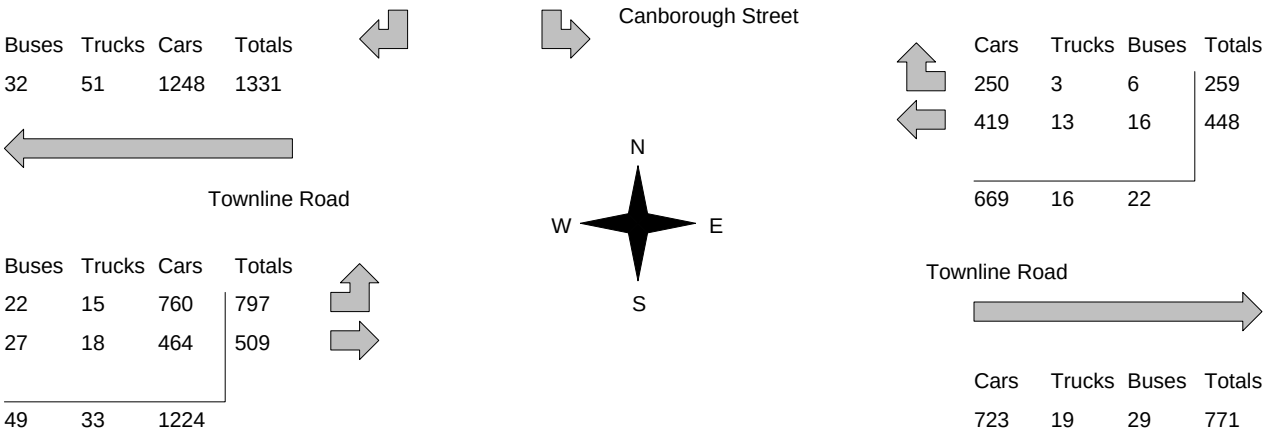
Major Road: Townline Road runs W/E

North Leg Total: 2201
North Entering: 1145
North Peds: 3
Peds Cross: ⋈

Buses	16	2	18
Trucks	38	1	39
Cars	829	259	1088
Totals	883	262	

Buses	28
Trucks	18
Cars	1010
Totals	1056

East Leg Total: 1478
East Entering: 707
East Peds: 18
Peds Cross: ⧖



Buses	Trucks	Cars	Totals
32	51	1248	1331

Cars	Trucks	Buses	Totals
250	3	6	259
419	13	16	448
669	16	22	

Buses	Trucks	Cars	Totals
22	15	760	797
27	18	464	509
49	33	1224	

Cars	Trucks	Buses	Totals
723	19	29	771

Peds Cross: ⧖
West Peds: 5
West Entering: 1306
West Leg Total: 2637

Comments

Townline Road & Canborough Street
Traffic Count Summary

Intersection: Townline Road & Canborough Stre | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	6	0	29	35	0	35
8:00:00	11	0	76	87	0	87
9:00:00	22	0	101	123	0	123
10:00:00	17	0	97	114	0	114
15:00:00	29	0	120	149	0	149
16:00:00	44	0	141	185	0	185
17:00:00	63	0	137	200	0	200
18:00:00	41	0	138	179	3	179
Totals:	233	0	839	1072	3	1072

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	0	0	0	0	0
9:00:00	0	0	0	0	0
10:00:00	0	0	0	0	0
15:00:00	0	0	0	0	0
16:00:00	0	0	0	0	0
17:00:00	0	0	0	0	0
18:00:00	0	0	0	0	0
Totals:	0	0	0	0	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	24	8	32	3	90
8:00:00	0	46	30	76	2	224
9:00:00	0	70	55	125	6	308
10:00:00	0	35	27	62	3	192
15:00:00	0	59	24	83	2	225
16:00:00	0	70	25	95	1	306
17:00:00	0	69	41	110	0	291
18:00:00	0	57	35	92	1	276
Totals:	0	430	245	675	18	1912

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	39	19	0	58	0
8:00:00	88	60	0	148	0
9:00:00	117	66	0	183	0
10:00:00	80	50	0	130	1
15:00:00	85	57	0	142	1
16:00:00	122	89	0	211	0
17:00:00	106	75	0	181	0
18:00:00	121	63	0	184	3
Totals:	758	479	0	1237	5

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	9	13	28	21	32	45	63	45

Townline Road & Port Davidson Road

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

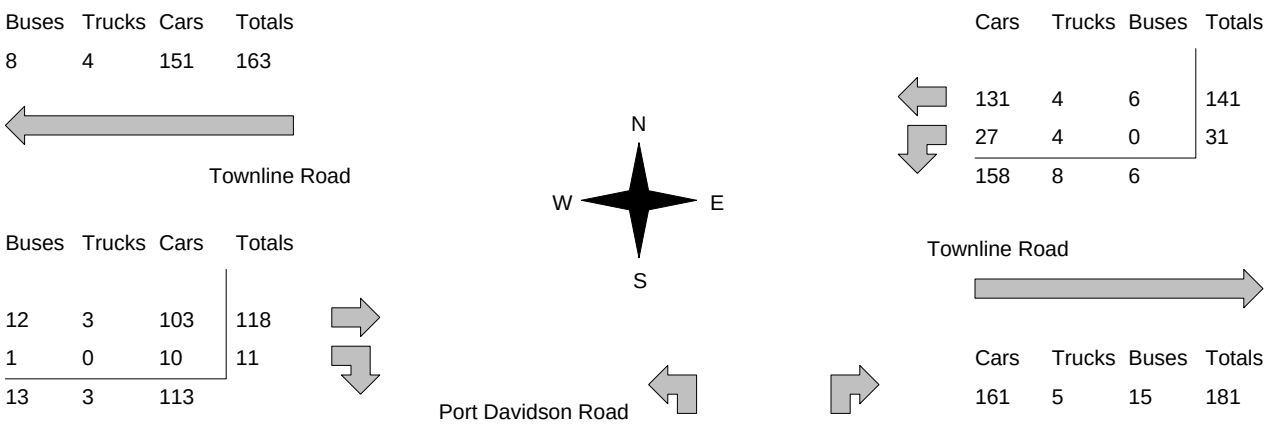
Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 353
East Entering: 172
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 2
West Entering: 129
West Leg Total: 292

Cars 37
Trucks 4
Buses 1
Totals 42

Cars 20 58 78
Trucks 0 2 2
Buses 2 3 5
Totals 22 63

Peds Cross: ⋈
South Peds: 8
South Entering: 85
South Leg Total: 127

Comments

Townline Road & Port Davidson Road

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 14:30:00
To: 15:30:00

Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

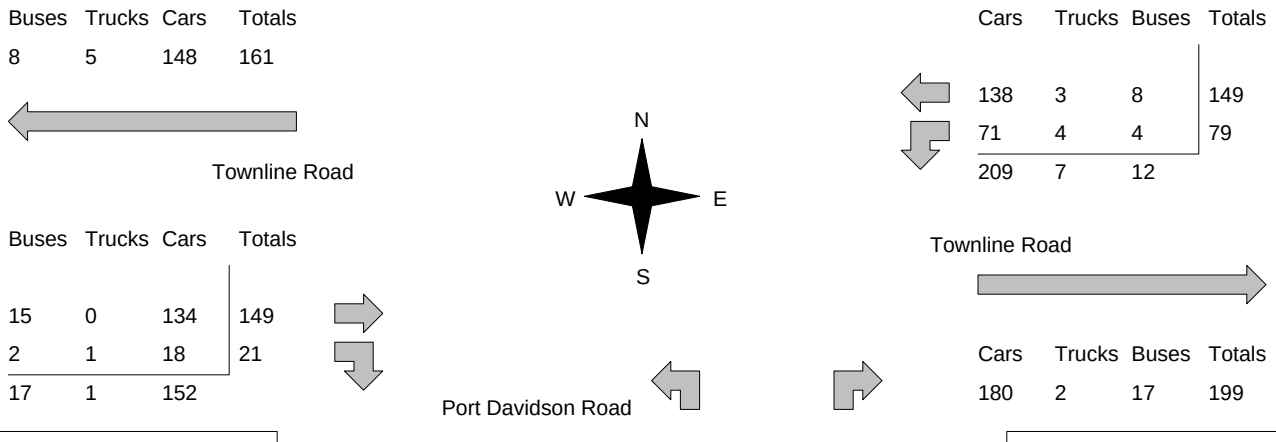
Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 427
East Entering: 228
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 170
West Leg Total: 331

Cars 89
Trucks 5
Buses 6
Totals 100

Cars 10 46 56
Trucks 2 2 4
Buses 0 2 2
Totals 12 50

Peds Cross: ⋈
South Peds: 5
South Entering: 62
South Leg Total: 162

Comments

Townline Road & Port Davidson Road

Total Count Diagram

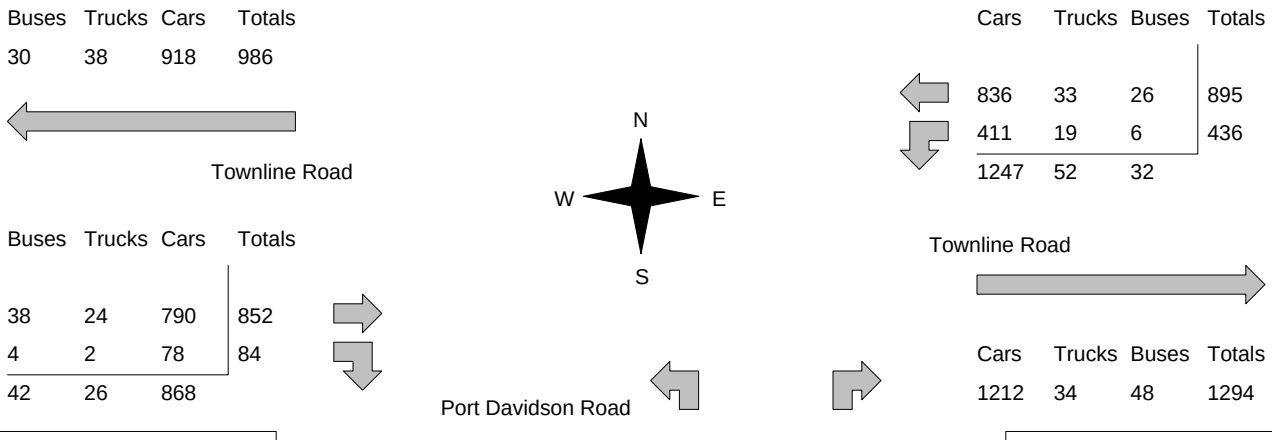
Municipality: Smithville
Site #: 0000002303
Intersection: Townline Road & Port Davidson Ro
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear
Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 2625
East Entering: 1331
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 3
West Entering: 936
West Leg Total: 1922

Cars 489
Trucks 21
Buses 10
Totals 520

Cars 82 422 504
Trucks 5 10 15
Buses 4 10 14
Totals 91 442

Peds Cross: ⋈
South Peds: 34
South Entering: 533
South Leg Total: 1053

Comments

Townline Road & Port Davidson Road
Traffic Count Summary

Intersection: Townline Road & Port Davidson Rd | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	37
8:00:00	0	0	0	0	0	76
9:00:00	0	0	0	0	0	85
10:00:00	0	0	0	0	0	58
15:00:00	0	0	0	0	0	66
16:00:00	0	0	0	0	0	47
17:00:00	0	0	0	0	0	68
18:00:00	0	0	0	0	0	66
Totals:	0	0	0	0	0	503

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	2	0	35	37	3
8:00:00	13	0	63	76	4
9:00:00	22	0	63	85	8
10:00:00	8	0	50	58	5
15:00:00	9	0	57	66	4
16:00:00	8	0	39	47	7
17:00:00	10	0	58	68	0
18:00:00	9	0	57	66	3
Totals:	81	0	422	503	34

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	17	36	0	53	0	82
8:00:00	43	79	0	122	0	220
9:00:00	31	141	0	172	0	301
10:00:00	38	94	0	132	0	216
15:00:00	58	118	0	176	0	265
16:00:00	68	146	0	214	0	407
17:00:00	92	109	0	201	0	331
18:00:00	68	134	0	202	0	333
Totals:	415	857	0	1272	0	2155

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	27	2	29	0
8:00:00	0	87	11	98	0
9:00:00	0	118	11	129	2
10:00:00	0	80	4	84	0
15:00:00	0	81	8	89	0
16:00:00	0	170	23	193	0
17:00:00	0	121	9	130	0
18:00:00	0	121	10	131	1
Totals:	0	805	78	883	3

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	2	13	24	8	9	8	10	10

Townline Road & Shurie Road

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 10:30:00

One Hour Peak
From: 8:00:00
To: 9:00:00

Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

North Leg Total:	6
North Entering:	4
North Peds:	17
Peds Cross:	⋈

Buses	0	0	0	0
Trucks	0	1	0	1
Cars	1	0	2	3
Totals	1	1	2	

Buses	0
Trucks	1
Cars	1
Totals	2

East Leg Total:	177
East Entering:	91
East Peds:	13
Peds Cross:	⧖

Carter Drive

Buses	Trucks	Cars	Totals
6	5	110	121

Cars	Trucks	Buses	Totals
0	0	0	0
74	5	3	82
8	0	1	9
82	5	4	

Townline Road

N
W E
S

Buses	Trucks	Cars	Totals
0	1	1	2
8	3	62	73
1	0	15	16
9	4	78	

Townline Road

Cars	Trucks	Buses	Totals
75	3	8	86

Shurie Road

Peds Cross:	⧖
West Peds:	4
West Entering:	91
West Leg Total:	212

Cars	23
Trucks	1
Buses	2
Totals	26

Cars	35	0	11	46
Trucks	0	0	0	0
Buses	3	0	0	3
Totals	38	0	11	

Peds Cross:	⋈
South Peds:	6
South Entering:	49
South Leg Total:	75

Comments

Townline Road & Shurie Road

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:00:00
To: 17:00:00

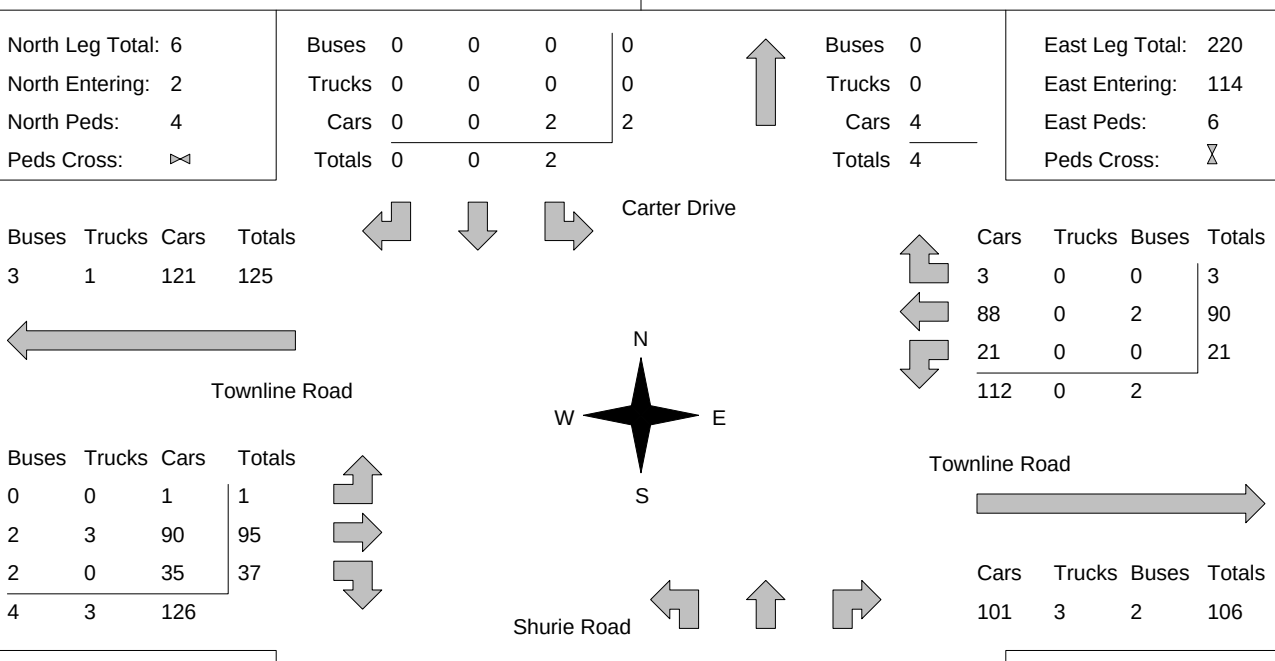
Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E



Comments

Townline Road & Shurie Road

Total Count Diagram

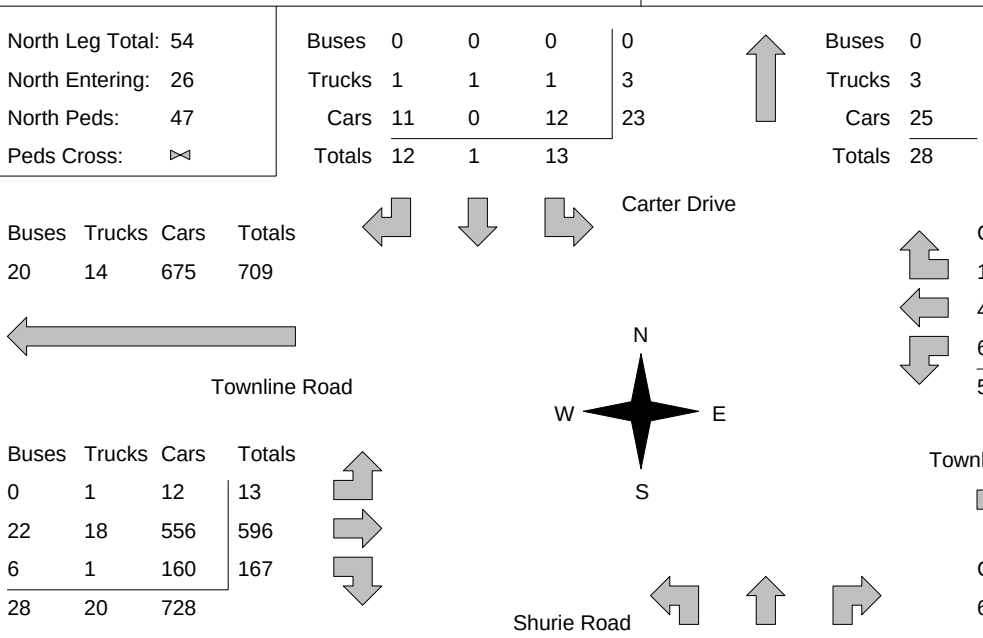
Municipality: Smithville
Site #: 0000002304
Intersection: Townline Road & Shurie Road
TFR File #: 1
Count date: 13-Jun-2024

Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E



Comments

Townline Road & Shurie Road
Traffic Count Summary

Intersection: Townline Road & Shurie Road | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	16
8:00:00	5	0	2	7	1	39
9:00:00	2	1	1	4	17	53
10:00:00	2	0	3	5	2	31
15:00:00	1	0	1	2	6	32
16:00:00	1	0	0	1	12	31
17:00:00	2	0	0	2	4	46
18:00:00	0	0	5	5	3	36
Totals:	13	1	12	26	45	284

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	13	0	3	16	8
8:00:00	23	0	9	32	1
9:00:00	38	0	11	49	6
10:00:00	14	0	12	26	7
15:00:00	19	0	11	30	5
16:00:00	20	0	10	30	1
17:00:00	35	0	9	44	0
18:00:00	21	0	10	31	1
Totals:	183	0	75	258	29

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	1	14	0	15	0	50
8:00:00	5	43	4	52	2	126
9:00:00	9	82	0	91	13	182
10:00:00	3	37	1	41	0	105
15:00:00	9	60	1	70	5	157
16:00:00	12	76	4	92	11	227
17:00:00	21	90	3	114	6	247
18:00:00	7	77	1	85	1	186
Totals:	67	479	14	560	38	1280

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	30	5	35	0
8:00:00	3	62	9	74	0
9:00:00	2	73	16	91	4
10:00:00	0	59	5	64	1
15:00:00	1	62	24	87	0
16:00:00	3	99	33	135	0
17:00:00	1	95	37	133	0
18:00:00	0	74	27	101	3
Totals:	10	554	156	720	8

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	13	30	58	17	25	32	43	25

Townline Road & Alma Drive

Morning Peak Diagram

Specified Period	One Hour Peak
From: 6:30:00	**From:** 8:00:00
To: 10:30:00	**To:** 9:00:00

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

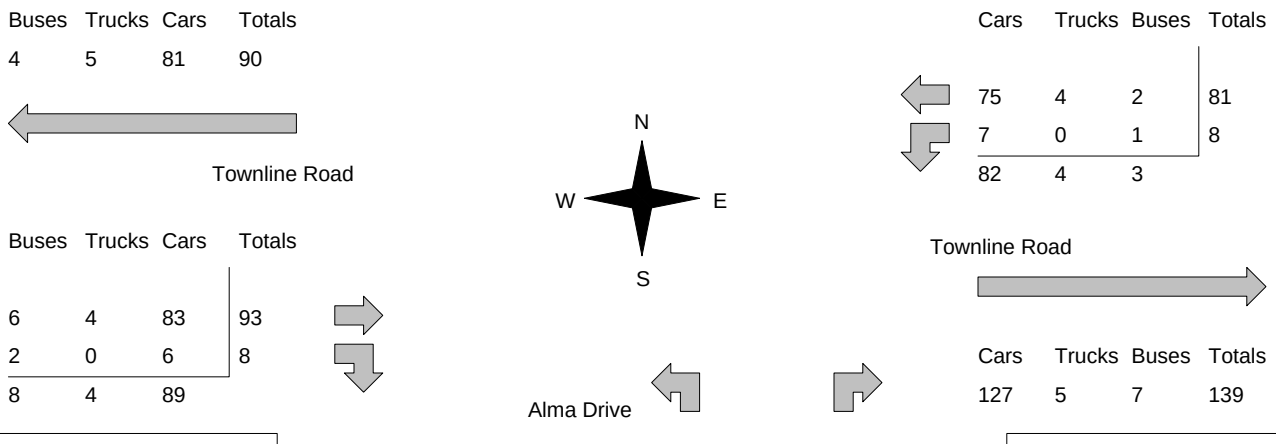
Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 228
East Entering: 89
East Peds: 0
Peds Cross: ⧖



Peds Cross:	⧖		Cars	13		Cars	6	44	50
West Peds:	0		Trucks	0		Trucks	1	1	2
West Entering:	101		Buses	3		Buses	2	1	3
West Leg Total:	191		Totals	16		Totals	9	46	

Peds Cross: ⋈
South Peds: 3
South Entering: 55
South Leg Total: 71

Comments

Townline Road & Alma Drive

Afternoon Peak Diagram

Specified Period
From: 14:30:00
To: 18:30:00

One Hour Peak
From: 16:30:00
To: 17:30:00

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

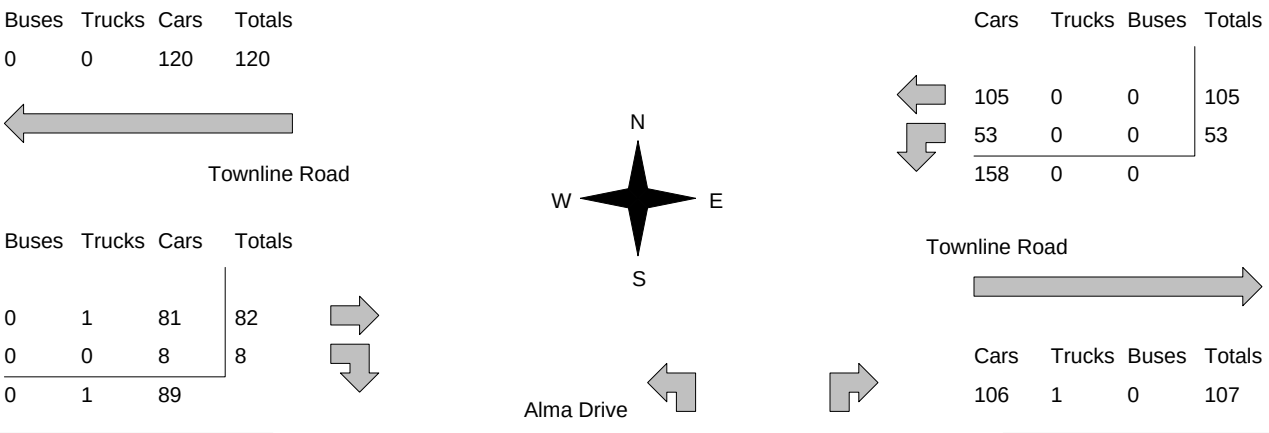
Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 265
East Entering: 158
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 90
West Leg Total: 210

Cars 61
Trucks 0
Buses 0
Totals 61

Cars 15 25 40
Trucks 0 0 0
Buses 0 0 0
Totals 15 25

Peds Cross: ⋈
South Peds: 2
South Entering: 40
South Leg Total: 101

Comments

Townline Road & Alma Drive

Total Count Diagram

Municipality: Smithville
Site #: 0000002305
Intersection: Townline Road & Alma Drive
TFR File #: 1
Count date: 13-Jun-2024

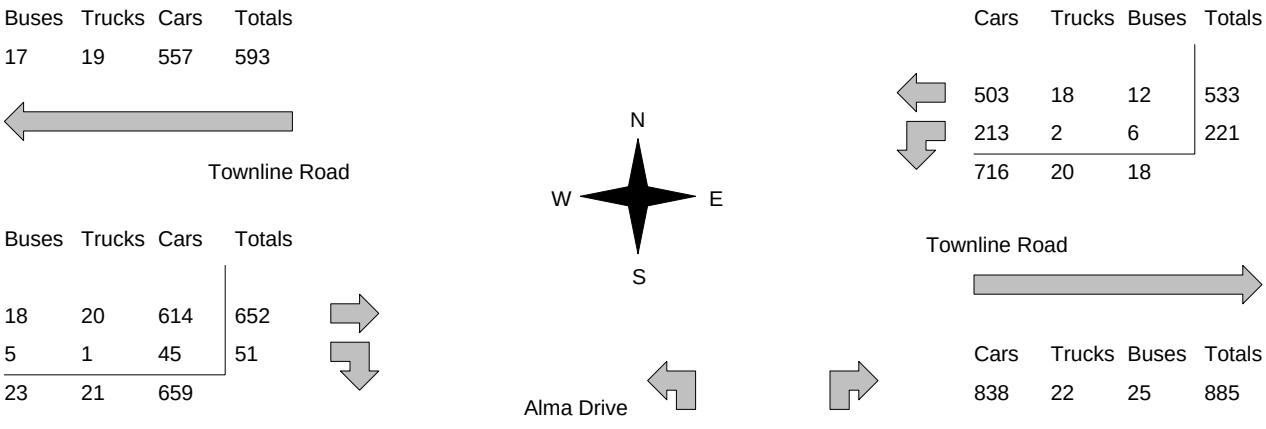
Weather conditions:
Clear

Person(s) who counted:

**** Non-Signalized Intersection ****

Major Road: Townline Road runs W/E

East Leg Total: 1639
East Entering: 754
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 703
West Leg Total: 1296

Cars 258
Trucks 3
Buses 11
Totals 272

Cars 54 224 278
Trucks 1 2 3
Buses 5 7 12
Totals 60 233

Peds Cross: ⋈
South Peds: 28
South Entering: 293
South Leg Total: 565

Comments

Townline Road & Alma Drive
Traffic Count Summary

Intersection: Townline Road & Alma Drive | **Count Date:** 13-Jun-2024 | **Municipality:** Smithville

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	22
8:00:00	0	0	0	0	0	56
9:00:00	0	0	0	0	0	55
10:00:00	0	0	0	0	0	20
15:00:00	0	0	0	0	0	24
16:00:00	0	0	0	0	0	32
17:00:00	0	0	0	0	0	31
18:00:00	0	0	0	0	0	42
Totals:	0	0	0	0	0	282

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	5	0	17	22	3
8:00:00	11	0	45	56	2
9:00:00	9	0	46	55	3
10:00:00	2	0	18	20	7
15:00:00	3	0	21	24	3
16:00:00	8	0	24	32	1
17:00:00	10	0	21	31	1
18:00:00	9	0	33	42	5
Totals:	57	0	225	282	25

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	6	12	0	18	0	61
8:00:00	12	34	0	46	0	125
9:00:00	8	81	0	89	0	190
10:00:00	20	34	0	54	0	129
15:00:00	22	67	0	89	0	159
16:00:00	35	87	0	122	0	233
17:00:00	47	105	0	152	0	249
18:00:00	46	86	0	132	0	215
Totals:	196	506	0	702	0	1361

West Approach Totals

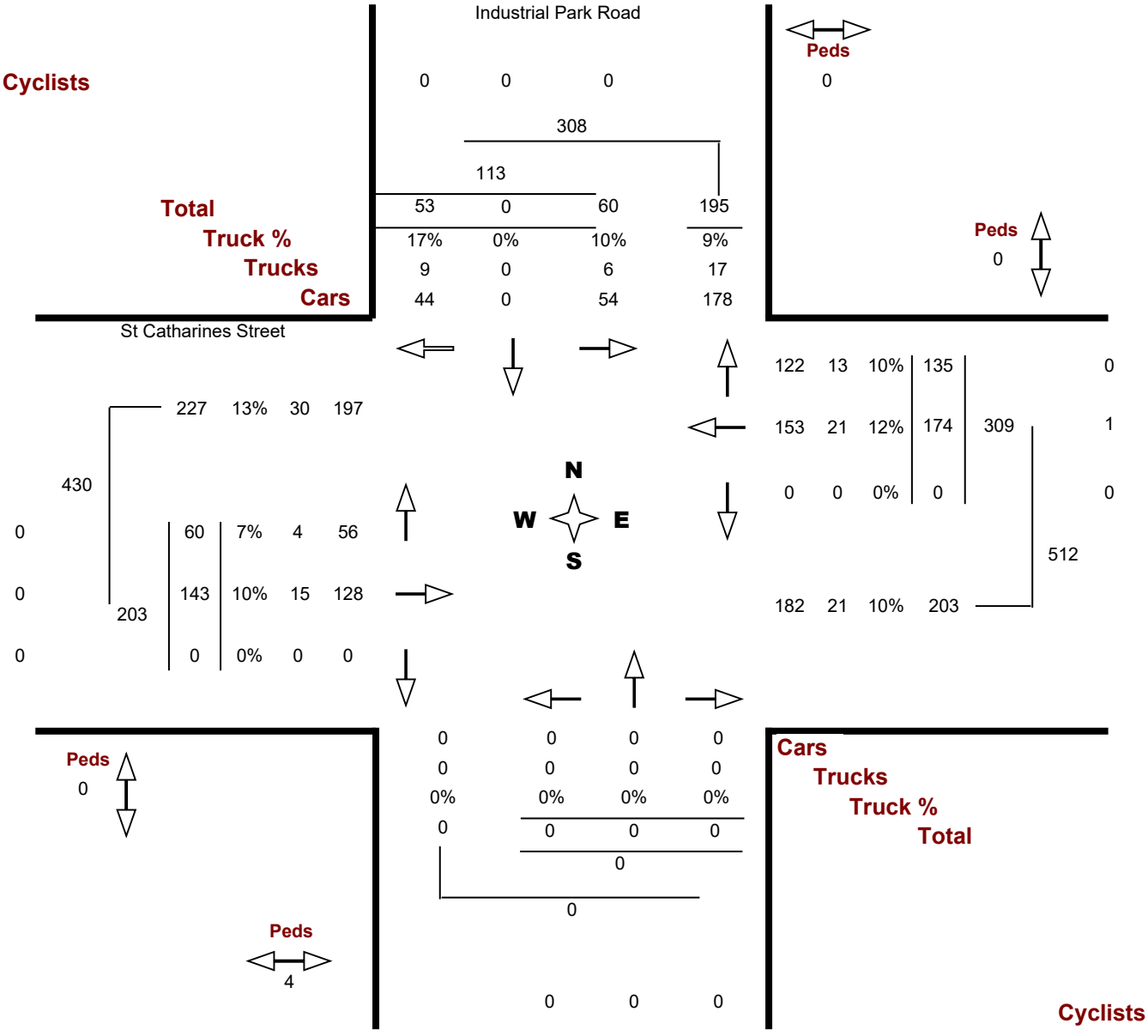
Hour Ending	Includes Cars, Trucks, & Buses: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	42	1	43	0
8:00:00	0	74	5	79	0
9:00:00	0	93	8	101	0
10:00:00	0	72	3	75	0
15:00:00	0	66	4	70	0
16:00:00	0	102	9	111	0
17:00:00	0	91	6	97	0
18:00:00	0	72	11	83	0
Totals:	0	612	47	659	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00
Crossing Values:	5	11	9	2	3	8	10	9

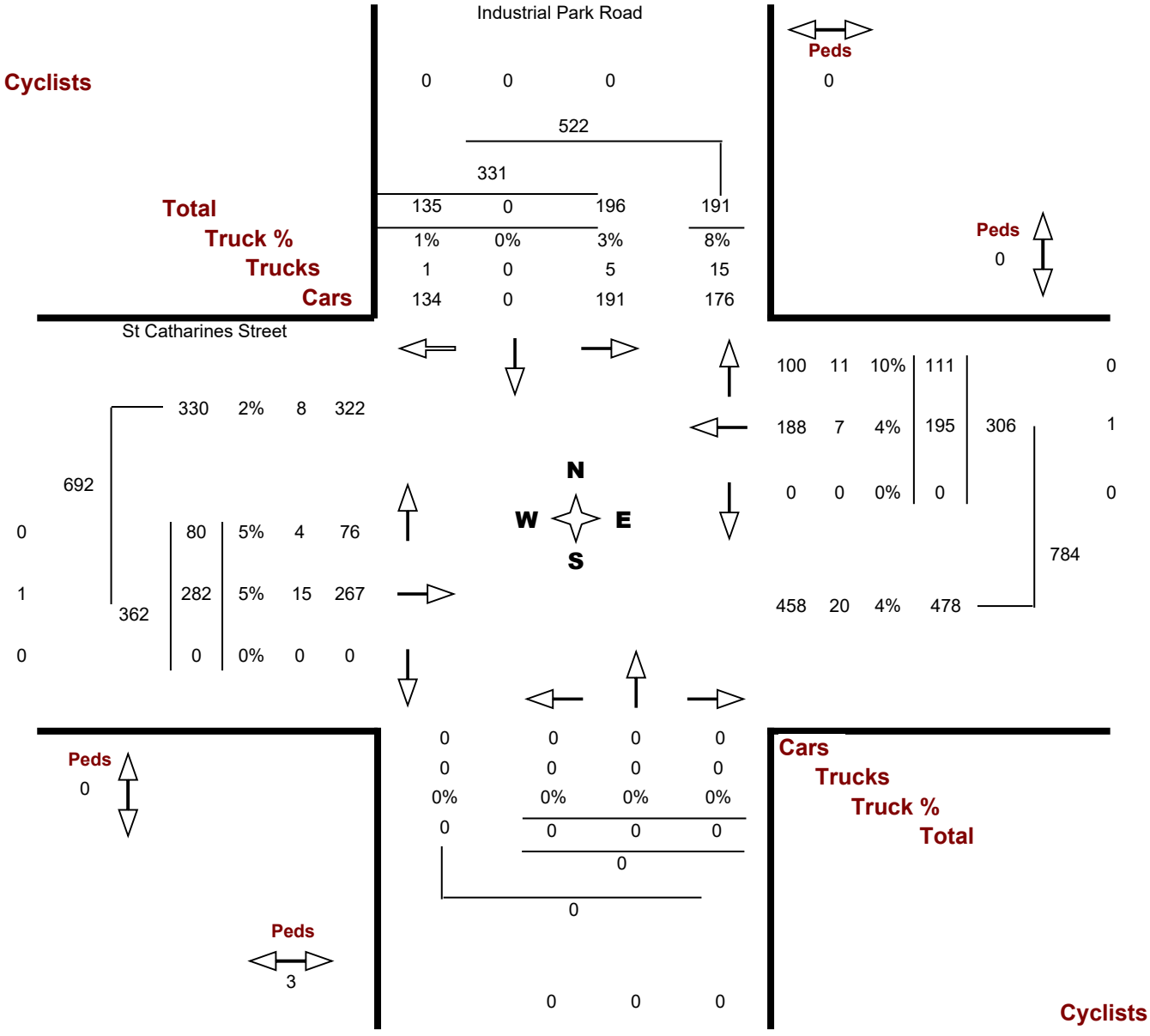
Turning Movements Report - AM Period

Location.....	Industrial Park Road @ St Catharines Street	**GeoID.....**	00085
Municipality.	WEST LINCOLN	**Count Date.**	Thursday, 15 June, 2023
Traffic Cont.		**Count Time.**	07:00 AM — 09:00 AM
Major Dir.....	East west	**Peak Hour..**	08:00 AM — 09:00 AM



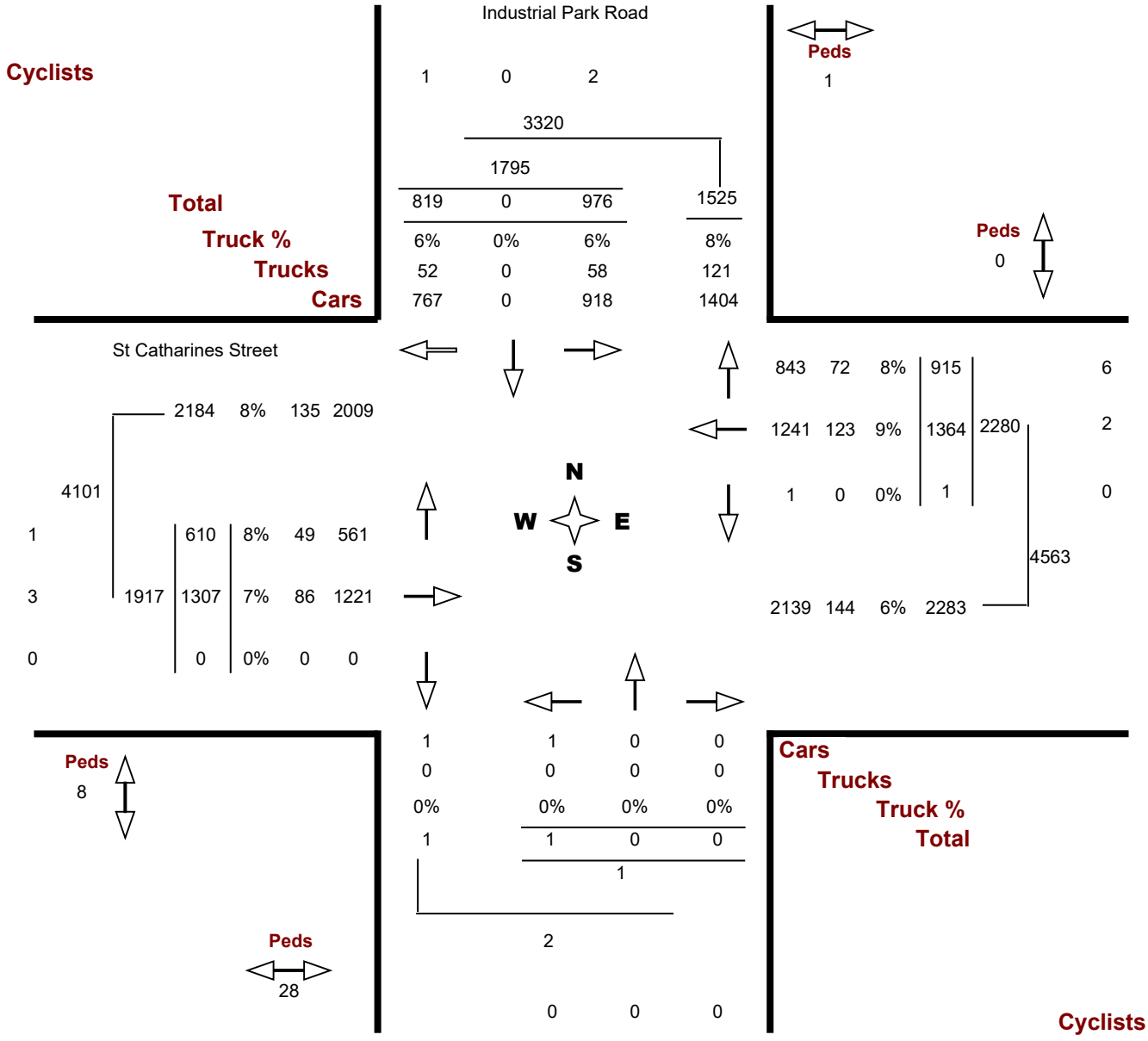
Turning Movements Report - PM Period

Location..... Industrial Park Road @ St Catharines Street
GeoID..... 00085
Municipality. WEST LINCOLN
Count Date. Thursday, 15 June, 2023
Traffic Cont.
Count Time. 03:00 PM — 06:00 PM
Major Dir..... East west
Peak Hour.. 04:30 PM — 05:30 PM



Turning Movement Count Report
Full Study

Location..... Industrial Park Road @ St Catharines Street
Municipality..... WEST LINCOLN
GeoID..... 00085
Count Date..... Thursday, 15 June, 2023



Turning Movement Count - Details Report (15 min)

Location..... Industrial Park Road @ St Catharines Street

Municipality..... WEST LINCOLN

Count Date..... Thursday, June 15, 2023

		Industrial Park Road										St Catharines Street									
		North Approach					South Approach					East Approach					West Approach				
Time Period		LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
07:00	07:15	30	0	15	0	45	0	0	0	0	0	0	45	27	0	72	6	20	0	0	26
07:15	07:30	13	0	14	0	27	0	0	0	0	0	0	60	34	0	94	10	35	0	0	45
07:30	07:45	11	0	8	0	19	0	0	0	0	0	0	50	46	0	96	18	17	0	0	35
07:45	08:00	10	0	4	0	14	0	0	0	0	0	0	48	37	0	85	16	39	0	0	55
Hourly Total		64	0	41	0	105	0	0	0	0	0	0	203	144	0	347	50	111	0	0	161
08:00	08:15	12	0	12	0	24	0	0	0	0	0	0	40	29	0	69	8	41	0	0	49
08:15	08:30	18	0	11	0	29	0	0	0	0	0	0	43	30	0	73	15	30	0	0	45
08:30	08:45	15	0	9	0	24	0	0	0	0	0	0	42	39	0	81	21	33	0	0	54
08:45	09:00	15	0	21	0	36	0	0	0	0	0	0	49	37	0	86	16	39	0	0	55
Hourly Total		60	0	53	0	113	0	0	0	0	0	0	174	135	0	309	60	143	0	0	203
11:00	11:15	28	0	19	0	47	0	0	0	0	0	0	26	19	0	45	27	34	0	0	61
11:15	11:30	18	0	25	0	43	0	0	0	0	0	0	32	25	0	57	21	28	0	0	49
11:30	11:45	20	0	18	0	38	1	0	0	0	1	0	40	27	0	67	20	41	0	0	61
11:45	12:00	25	0	25	0	50	0	0	0	0	0	0	45	36	0	81	16	29	0	0	45
Hourly Total		91	0	87	0	178	1	0	0	0	1	0	143	107	0	250	84	132	0	0	216
12:00	12:15	38	0	25	0	63	0	0	0	0	0	0	40	15	0	55	22	35	0	0	57
12:15	12:30	27	0	29	0	56	0	0	0	0	0	0	36	34	0	70	28	29	0	0	57
12:30	12:45	27	0	29	0	56	0	0	0	0	0	0	36	26	0	62	24	26	0	0	50
12:45	13:00	23	0	33	0	56	0	0	0	0	0	0	29	23	0	52	22	33	0	0	55
Hourly Total		115	0	116	0	231	0	0	0	0	0	0	141	98	0	239	96	123	0	0	219
13:00	13:15	27	0	33	0	60	0	0	0	0	0	0	43	25	0	68	28	34	0	0	62
13:15	13:30	28	0	29	0	57	0	0	0	0	0	0	35	27	0	62	26	37	0	0	63
13:30	13:45	26	0	20	0	46	0	0	0	0	0	0	36	25	0	61	29	29	0	0	58
13:45	14:00	29	0	28	0	57	0	0	0	0	0	0	36	27	0	63	17	35	0	0	52
Hourly Total		110	0	110	0	220	0	0	0	0	0	0	150	104	0	254	100	135	0	0	235
15:00	15:15	63	0	49	0	112	0	0	0	0	0	0	34	24	0	58	21	54	0	0	75
15:15	15:30	49	0	28	0	77	0	0	0	0	0	0	40	27	0	67	19	42	0	0	61
15:30	15:45	44	0	33	0	77	0	0	0	0	0	0	38	26	0	64	21	48	0	0	69
15:45	16:00	42	0	40	0	82	0	0	0	0	0	0	50	19	0	69	18	43	0	0	61
Hourly Total		198	0	150	0	348	0	0	0	0	0	0	162	96	0	258	79	187	0	0	266
16:00	16:15	37	0	34	0	71	0	0	0	0	0	0	44	26	0	70	13	46	0	0	59

		Industrial Park Road										St Catharines Street									
		North Approach					South Approach					East Approach					West Approach				
Time Period		LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
16:15	16:30	47	0	36	0	83	0	0	0	0	0	0	52	28	0	80	18	50	0	0	68
16:30	16:45	52	0	36	0	88	0	0	0	0	0	0	42	32	0	74	16	88	0	0	104
16:45	17:00	34	0	26	0	60	0	0	0	0	0	0	46	20	0	66	22	54	0	0	76
Hourly Total		170	0	132	0	302	0	0	0	0	0	0	184	106	0	290	69	238	0	0	307
17:00	17:15	62	0	40	0	102	0	0	0	0	0	0	48	30	0	78	18	75	0	0	93
17:15	17:30	48	0	33	0	81	0	0	0	0	0	0	59	29	0	88	24	65	0	0	89
17:30	17:45	30	0	28	0	58	0	0	0	0	0	1	54	30	0	85	13	54	0	0	67
17:45	18:00	28	0	29	0	57	0	0	0	0	0	0	46	36	0	82	17	44	0	0	61
Hourly Total		168	0	130	0	298	0	0	0	0	0	1	207	125	0	333	72	238	0	0	310
Grand Total		976	0	819	0	1795	1	0	0	0	1	1	1364	915	0	2280	610	1307	0	0	1917
Truck %		6%	0%	6%	0%	6%	0%	0%	0%	0%	0%	0%	9%	8%	0%	9%	8%	7%	0%	0%	7%

APPENDIX B

Terms of Reference and Consultation with Township of West Lincoln and Region of Niagara

From: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Sent: Thursday, March 28, 2024 4:24 AM
To: Yip, Wilson
Cc: Wilson, Connor; Mirhoseini, Arash; Del Rosario, Christine; Kapolnas, Stephen; Mammel, Suzanne; Bureau, Stephen
Subject: RE: Traffic Impact Study (TIS) in support of Smithville Block 3A Area 9 Phase 1 Development: Overview and Request for Available Information from Region

Follow Up Flag: Follow up
Flag Status: Flagged

Good Morning

Regional transportation planning staff has reviewed the terms of reference and has added their comments in green. For Regional traffic data requests please use the following link: https://www.niagararegion.ca/living/roads/permits/traffic-data-requests.aspx

Any improvements to Regional roads and infrastructure require functional designs to be included in the TIS submitted for review and approval.

If you require anything further please contact me at your convenience.

Thank you

Growing Better Together
Niagara Region

Susan M. Dunsmore, P.Eng.
ACTING DIRECTOR, INFRASTRUCTURE PLANNING &DEVELOPMENT ENGINEERING
Niagara Region, 1815 Sir Isaac Brock Way, Thorold, ON, L2V 4T7

P : (905) 980 - 6000 ext. 3661
W : www.niagararegion.ca
E : susan.dunsmore@niagararegion.ca

From: Yip, Wilson <Wilson.Yip@stantec.com>
Sent: Wednesday, March 20, 2024 3:44 PM
To: Dunsmore, Susan <Susan.Dunsmore@niagararegion.ca>
Cc: Wilson, Connor <Connor.Wilson@niagararegion.ca>; Mirhoseini, Arash <Arash.Mirhoseini@stantec.com>; Del Rosario, Christine <Christine.DelRosario@stantec.com>; Kapolnas, Stephen <Steve.Kapolnas@stantec.com>; Mammel, Suzanne <Suzanne.Mammel@stantec.com>
Subject: Traffic Impact Study (TIS) in support of Smithville Block 3A Area 9 Phase 1 Development: Overview and Request for Available Information from Region

Good afternoon Susan,

My name is Wilson. I am working with Christine on a Traffic Impact Study (TIS) in support of a proposed development in Smithville – Smithville Block 3A Area 9 Phase 1. Thanks for responding to Christine's inquiry and connecting us with Connor.

To provide you with some background information, the development site is located approximately 800m west of the intersection of Townline Road and St Catharines Street in the Township of West Lincoln, Ontario (see figure below).

We submitted a Terms of Reference (ToR) to the Township back in January/February, which included a series of data request. The approved ToR, with the comments that we received from the Township in red, is attached as PDF and provided as follows:

"We would appreciate it if the Township could provide us with the following transportation related data to be used in the traffic impact study:

- Turning Movement Counts (TMC) at the following study area intersections: The Township does not have TMC data to provide, the Niagara Region may be able to assist with data for their roads
    - Townline Road and St Catharines Street (Roundabout) St. Catharines St is Regional road
    - Townline Road and Canborough Street (Unsignalized) Canborough St is a Regional road
    - Townline Road and Port Davidson Road (Unsignalized) Townline Rd west of Canborough St is a Regional road
    - Staff believe the intersections of Townline Road and Shurie Road should also be reviewed, and Townline Road and Alma Dr for the full Block Plan 9 area.
    - Please review the intersection of St Catharines Street (Regional Road 20) & Industrial Park Road (unsignalized); TMC available June 2023

- Any historical AADT or mid-block traffic counts available along study area corridors: the last traffic counts for Township roads are out of date, your consultant should acquire new data
    - Townline Road
    - St Catharines Street
    - Canborough Street, and
    - Port Davidson Road
    - Shurie Road
    - Alma Dr
- Future background developments including the information or assumptions to be used in this TIS for the other phases/subphases of Smithville MCEA including the land use and expected build-out. The development of 2 parcels within the East Smithville Secondary Plan area located on the north side of St. Catharines St at the roundabout with Townline Rd to construct approximately 725 units is in the process of submitting applications so that is a likely consideration for timing.
- Future transportation network mitigations and infrastructure plans adjacent to the study area and their expected completion to be included in the TIS. Road network improvements required for growth are available in the TMP

- Traffic growth rate and transit data for the study area section 3.2.1 of the TMP discusses growth rate. Niagara Region Transit offers OnDemand transit to West Lincoln residents throughout the Region, there are no local transit services offered, transportation in town is primarily private vehicle use. The Region's forecasting EMME model output recommends using an annual growth rate of 3%.

- Truck routes and limitations, and there are no designated truck routes for the roads in the immediate area
  Any guideline or design criteria to be used in the TIS study including access requirements, specific design vehicles (fire trucks, waste collection truck), etc. refer to Niagara Region Access Guidelines" The updated Niagara Region Transportation Impact Assessment guidelines and Access Management guidelines are both accessible at: https://www.niagararegion.ca/business/default.aspx?topnav=1

The Township also provided us with the Region's Traffic Impact Assessment and Access Management Guidelines. We were also able to obtain the Average Annual Daily Traffic volumes (AADTs) in 2020 from some of the relevant road segments in our study area in the Region's Open Data Portal, NiagaraOpenData.ca (see attached spreadsheet). Please let us know if there is any updated version of this data available.

Given the response from the Township, we would like to request the following traffic data from the Region:

1. Turning movement counts (TMCs), if available, from the following intersections: The Region do not have recent TMC's for following intersections.
   - Townline Road and St Catharines Street (Roundabout)
   - Townline Road and Canborough Street (Unsignalized)
   - Townline Road and Port Davidson Road (Unsignalized)
   - Townline Road and Shurie Road/Carter Drive (Unsignalized)
   - Townline Road and Alma Drive (Unsignalized)
2. Mid-block traffic counts, if available, along the following corridors: The AADTs volumes you have are the most recent data available.
   - Townline Road
   - St Catharines Street
   - Canborough Street
   - Port Davidson Road

We understand that some of the intersections (e.g. Townline Rd and Shurie Rd/Carter Dr, Townline Rd and Alma Dr) and road segments (e.g. Port Davidson Rd, Townline Rd east of Canborough St) are not under the Region's jurisdiction, but just want to make sure that we have all available data located.

In addition to the data requested, please provide any documents that you believe should be considered in our study.

Just for your information, please note that this subdivision is within the proximity of Regional Road 20 Reconstruction project. For future road improvements and resurfacing along the regional road, please review updates found in the Region's website:
https://www.niagararegion.ca/projects/regional-road-20

Please feel free to contact Christine or myself if you need further clarifications on the information shared, or if you have any questions, comments, or concerns.

Best regards,

Wilson Yip B.ASc., M.Eng. (he/him/his)
Senior Transportation Planner

Direct: 416-507-3479
Wilson.Yip@stantec.com

100-401 Wellington St W
Toronto ON M5V 1E7

Stantec Consulting Ltd.
300 – 675 Cochrane Drive West tower, Markham, ON L3R 0B8

December 13, 2023
File: 161414102

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

The purpose of this letter is to present the proposed Terms of Reference for Smithville Block 3A Transportation Impact Study (TIS) to the Township of West Lincoln and the Region of Niagara to confirm scope, methodology and assumptions to conduct the required study for the proposed development. This document provides the opportunity to consult and confirm with the Township and the Region, the methodology and data to be used in this study. The Site is located approximately 800m west of the intersection of Townline Road and St Catharines Street in the Township of West Lincoln, Ontario.

The scope presented within this document is based on the available information at the time of preparation and follows the requirements outlines in the "Niagara Region Guidelines for Transportation Impact Studies" dated May 2012.

STUDY AREA

The proposed study area includes the following intersections:

- Townline Road and St Catharines Street (Roundabout)
- Townline Road and Canborough Street (Unsignalized)
- Townline Road and Port Davidson Road (Unsignalized), and
- Townline Road and Site Access (Unsignalized)

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

Figure 1: Study Area Intersections

STUDY HORIZONS

The study horizons are proposed to include the following scenarios:

- Existing Conditions (2024) Weekday AM/PM Peak Hours
- Future Background Horizon (2029) Weekday AM/PM Peak Hours, and
- Future Total Horizon (2029) Weekday AM/PM Peak Hours

TIS SCOPE:

Based on our review of the proposed development, the surrounding context, Township of West Lincoln Comprehensive Block Plan and MESP Guidelines and the Region's TIS requirements, the following scope of work is proposed:

1. **Pre-Consultation**: This ToR document provides the opportunity to consult with the Township to conduct a pre-consultation and agree on the study specific requirements to confirm the study area, scope of work, and background transportation assumptions to be included in this TIS study.

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

2. **Data Collection:** We will submit a data collection request to the Township to obtain the transportation related data required for the study. The main data that will be collected is listed as follows:
    - Turning Movement Counts (TMC) at study area intersections
    - Any historical AADT or mid-block traffic counts available along study area corridors
    - Future background developments and infrastructure plans adjacent to the study area (within the TIS study horizons)
    - Traffic growth rate and transit data for the study area, and
    - Truck routes and limitations

3. **Existing Conditions:** We will document intersection and roadway lane configurations, existing turning and parking restrictions, active transportation facilities, and transit service and facilities within the study area.
4. **Existing Operations:** An intersection operational analysis will be conducted for the existing conditions at the study area intersections during the weekday AM and PM peak hours. Synchro software will be utilized to conduct this operational analysis. The analysis will follow the Region TIS Guideline requirements.
5. **Future Conditions:** The future conditions will document the planned works in the study area which would affect the operational conditions of automobiles, active transportation connectivity, and transit service. The planned works in the study area will be incorporated into the future background and future total road networks.
6. **Future Background Operations:** We will conduct operational analysis for the future background conditions at the study area intersections during the weekday AM and PM peak hours. The future background traffic will include the nearby development traffic and the existing traffic volumes projected to represent the volumes during the future horizon.
7. **Site Trips:** Site trips for the proposed development will be estimated for the weekday AM and PM peak hours based on the latest ITE Trip Generation Manual, 11th Edition and the proposed development land use plan.
8. **Trip Distribution & Assignment:** The trip distribution and assignment for the proposed development will be estimated using existing traffic count patterns , the information that will be extracted from 2016 TTS dataset for the adjacent area, and the available road network.
9. **Future Total Operations:** We will conduct an intersection operational analysis for the future total conditions at the study area intersections during the weekday AM and PM peak hours. The future total traffic includes the background development traffic, the existing traffic volumes grown to represent the volumes during the future horizons, and the site additional generated traffic.
10. **Access Study:** We will assess the site accesses and internal circulation and will conduct a sightline assessment at the proposed site access following the methodology outlined in the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, 2017.

Reference: Term of Reference for Transportation Impact Study | Smithville Block 3A, Township of West Lincoln

11. **Mitigation Measures:** We will highlight and propose mitigation measures to any issues that may arise out of the study. We note that this does not include design services, but a traffic operational assessment of mitigation measures. Design solutions can be developed, if required, based on separate client authorization.
12. **Prepare Draft Report:** The recommendations and conclusions based on the above findings will be documented in a Draft Report and included in the Block Plan submission.
13. **Finalize Report:** Once the Township and Region have reviewed the transportation/traffic components described above we will liaise with these agencies, address comments and prepare a final report.

APPENDIX C

Trip Estimation for North Leg of Sterling Street and Rock Street

Land Use Code	Variable	Units	Trip Generation Rates	Total Trip Generation	IN		OUT	
					%	#	%	#
Phase 1 Development - Block Plan Area 9								
AM Peak Hour								
210	Dwelling Units	76	Ln(T) = 0.91 Ln(X) + 0.12	60	25 %	15	75 %	45
			Trips Per Access	**20**		**5**		**15**
PM Peak Hour								
210	Dwelling Units	76	Ln(T) = 0.94 Ln(X) + 0.27	75	63 %	48	37 %	27
			Trips Per Access	**25**		**16**		**9**

Trips generated divided equally among three potential accesses (Rock Street & Townline Road, Sterling Street & Townline Road and Rock Street & Canborough Street) to residential area north of Townline Road.

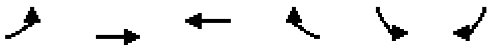
APPENDIX D

Synchro Outputs – Existing Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	118	11	31	141	22	63
Future Volume (Veh/h)	118	11	31	141	22	63
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	128	12	34	153	24	68
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			140		355	134
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			140		355	134
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			98		96	92
cM capacity (veh/h)			1378		614	899

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	140	187	92
Volume Left	0	34	24
Volume Right	12	0	68
cSH	1700	1378	802
Volume to Capacity	0.08	0.02	0.11
Queue Length 95th (m)	0.0	0.6	2.9
Control Delay (s/veh)	0.0	1.6	10.1
Lane LOS		A	B
Approach Delay (s/veh)	0.0	1.6	10.1
Approach LOS			B

Intersection Summary			
Average Delay		2.9	
Intersection Capacity Utilization		31.1%	ICU Level of Service
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	117	66	70	55	22	101
Future Volume (vph)	117	66	70	55	22	101
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	127	72	76	60	24	110

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	199	136	134
Volume Left (vph)	127	0	24
Volume Right (vph)	0	60	110
Hadj (s)	0.32	-0.10	-0.37
Departure Headway (s)	4.7	4.3	4.3
Degree Utilization, x	0.26	0.16	0.16
Capacity (veh/h)	747	788	778
Control Delay (s/veh)	9.3	8.2	8.1
Approach Delay (s/veh)	9.3	8.2	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	8.6		
Level of Service	A		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	117	66	70	55	22	101
Future Vol, veh/h	117	66	70	55	22	101
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	6	20	10	9	0	6
Mvmt Flow	127	72	76	60	24	110
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	9.1	8.2	8
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	64%	0%	18%
Vol Thru, %	36%	56%	0%
Vol Right, %	0%	44%	82%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	183	125	123
LT Vol	117	0	22
Through Vol	66	70	0
RT Vol	0	55	101
Lane Flow Rate	199	136	134
Geometry Grp	1	1	1
Degree of Util (X)	0.253	0.163	0.156
Departure Headway (Hd)	4.585	4.321	4.205
Convergence, Y/N	Yes	Yes	Yes
Cap	788	832	854
Service Time	2.585	2.341	2.224
HCM Lane V/C Ratio	0.253	0.163	0.157
HCM Control Delay, s/veh	9.1	8.2	8
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1	0.6	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	73	16	9	82	0	38	0	11	2	1	1
Future Volume (vph)	2	73	16	9	82	0	38	0	11	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	79	17	10	89	0	41	0	12	2	1	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	98	99	53	4
Volume Left (vph)	2	10	41	2
Volume Right (vph)	17	0	12	1
Hadj (s)	0.14	0.19	0.12	0.38
Departure Headway (s)	4.3	4.3	4.5	4.8
Degree Utilization, x	0.12	0.12	0.07	0.01
Capacity (veh/h)	823	815	764	707
Control Delay (s/veh)	7.8	7.9	7.8	7.8
Approach Delay (s/veh)	7.8	7.9	7.8	7.8
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.9			
Level of Service	A			
Intersection Capacity Utilization	19.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	73	16	9	82	0	38	0	11	2	1	1
Future Vol, veh/h	2	73	16	9	82	0	38	0	11	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	50	15	6	11	10	0	8	0	0	0	100	0
Mvmt Flow	2	79	17	10	89	0	41	0	12	2	1	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	8.6	7.9	7.9	7.4
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	78%	2%	10%	50%
Vol Thru, %	0%	80%	90%	25%
Vol Right, %	22%	18%	0%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	49	91	91	4
LT Vol	38	2	9	2
Through Vol	0	73	82	1
RT Vol	11	16	0	1
Lane Flow Rate	53	99	99	4
Geometry Grp	1	1	1	1
Degree of Util (X)	0.067	0.133	0.118	0.005
Departure Headway (Hd)	4.543	4.825	4.282	4.393
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	793	737	827	819
Service Time	2.543	2.893	2.363	2.395
HCM Lane V/C Ratio	0.067	0.134	0.12	0.005
HCM Control Delay, s/veh	7.9	8.6	7.9	7.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.5	0.4	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	93	8	8	81	9	46
Future Volume (Veh/h)	93	8	8	81	9	46
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	101	9	9	88	10	50
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			110		212	106
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			110		212	106
tC, single (s)			4.2		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.8	3.3
p0 queue free %			99		99	95
cM capacity (veh/h)			1414		708	943

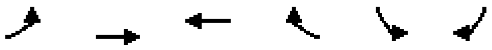
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	110	97	60
Volume Left	0	9	10
Volume Right	9	0	50
cSH	1700	1414	894
Volume to Capacity	0.06	0.01	0.07
Queue Length 95th (m)	0.0	0.1	1.6
Control Delay (s/veh)	0.0	0.7	9.3
Lane LOS		A	A
Approach Delay (s/veh)	0.0	0.7	9.3
Approach LOS			A

Intersection Summary			
Average Delay		2.4	
Intersection Capacity Utilization		20.9%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	62	55	227	176	62	147
Future Volume (Veh/h)	62	55	227	176	62	147
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	60	247	191	67	160
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	541	247			438	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	541	247			438	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	85	92			94	
cM capacity (veh/h)	459	756			1096	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	67	60	247	191	67	160
Volume Left	67	0	0	0	67	0
Volume Right	0	60	0	191	0	0
cSH	459	756	1700	1700	1096	1700
Volume to Capacity	0.15	0.08	0.15	0.11	0.06	0.09
Queue Length 95th (m)	3.9	2.0	0.0	0.0	1.5	0.0
Control Delay (s/veh)	14.2	10.2	0.0	0.0	8.5	0.0
Lane LOS	B	B			A	
Approach Delay (s/veh)	12.3		0.0		2.5	
Approach LOS	B					

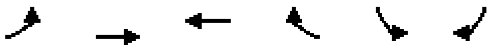
Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	28.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	84	119	3	8	8
Future Volume (Veh/h)	3	84	119	3	8	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	91	129	3	9	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	132				228	131
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	132				228	131
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1453				759	919

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	94	132	18
Volume Left	3	0	9
Volume Right	0	3	9
cSH	1453	1700	831
Volume to Capacity	0.00	0.08	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s/veh)	0.3	0.0	9.4
Lane LOS	A		A
Approach Delay (s/veh)	0.3	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	16.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	85	124	3	8	8
Future Volume (Veh/h)	3	85	124	3	8	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	92	135	3	9	9
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	138				235	137
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	138				235	137
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1446				752	912

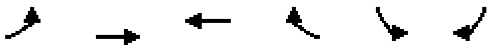
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	95	138	18
Volume Left	3	0	9
Volume Right	0	3	9
cSH	1446	1700	824
Volume to Capacity	0.00	0.08	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s/veh)	0.3	0.0	9.5
Lane LOS	A		A
Approach Delay (s/veh)	0.3	0.0	9.5
Approach LOS			A

Intersection Summary			
Average Delay		0.8	
Intersection Capacity Utilization		16.9%	ICU Level of Service
Analysis Period (min)		15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	149	21	79	149	12	50
Future Volume (Veh/h)	149	21	79	149	12	50
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	162	23	86	162	13	54
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			185		508	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			185		508	174
tC, single (s)			4.2		6.6	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.4
p0 queue free %			94		97	94
cM capacity (veh/h)			1343		467	855

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	185	248	67
Volume Left	0	86	13
Volume Right	23	0	54
cSH	1700	1343	736
Volume to Capacity	0.11	0.06	0.09
Queue Length 95th (m)	0.0	1.6	2.3
Control Delay (s/veh)	0.0	3.1	10.4
Lane LOS		A	B
Approach Delay (s/veh)	0.0	3.1	10.4
Approach LOS			B

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	120	71	68	40	57	152
Future Volume (vph)	120	71	68	40	57	152
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	130	77	74	43	62	165

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	207	117	227
Volume Left (vph)	130	0	62
Volume Right (vph)	0	43	165
Hadj (s)	0.16	-0.21	-0.34
Departure Headway (s)	4.7	4.5	4.3
Degree Utilization, x	0.27	0.15	0.27
Capacity (veh/h)	719	751	783
Control Delay (s/veh)	9.5	8.2	8.9
Approach Delay (s/veh)	9.5	8.2	8.9
Approach LOS	A	A	A

Intersection Summary			
Delay	9.0		
Level of Service	A		
Intersection Capacity Utilization	36.2%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	120	71	68	40	57	152
Future Vol, veh/h	120	71	68	40	57	152
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	3	1	1	0	0	3
Mvmt Flow	130	77	74	43	62	165
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	9.5	8.2	8.9
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	63%	0%	27%
Vol Thru, %	37%	63%	0%
Vol Right, %	0%	37%	73%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	191	108	209
LT Vol	120	0	57
Through Vol	71	68	0
RT Vol	0	40	152
Lane Flow Rate	208	117	227
Geometry Grp	1	1	1
Degree of Util (X)	0.272	0.145	0.27
Departure Headway (Hd)	4.716	4.449	4.278
Convergence, Y/N	Yes	Yes	Yes
Cap	762	805	841
Service Time	2.748	2.483	2.303
HCM Lane V/C Ratio	0.273	0.145	0.27
HCM Control Delay, s/veh	9.5	8.2	8.9
HCM Lane LOS	A	A	A
HCM 95th-tile Q	1.1	0.5	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	95	37	21	90	3	35	0	9	2	0	0
Future Volume (vph)	1	95	37	21	90	3	35	0	9	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	103	40	23	98	3	38	0	10	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	144	124	48	2
Volume Left (vph)	1	23	38	2
Volume Right (vph)	40	3	10	0
Hadj (s)	-0.08	0.05	0.11	0.20
Departure Headway (s)	4.1	4.2	4.6	4.7
Degree Utilization, x	0.16	0.15	0.06	0.00
Capacity (veh/h)	867	838	735	703
Control Delay (s/veh)	7.9	7.9	7.9	7.8
Approach Delay (s/veh)	7.9	7.9	7.9	7.8
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.9			
Level of Service	A			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	95	37	21	90	3	35	0	9	2	0	0
Future Vol, veh/h	1	95	37	21	90	3	35	0	9	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	5	5	0	2	0	6	0	0	0	0	0
Mvmt Flow	1	103	40	23	98	3	38	0	10	2	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	7.7	7.9	7.9	7.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	80%	1%	18%	100%
Vol Thru, %	0%	71%	79%	0%
Vol Right, %	20%	28%	3%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	44	133	114	2
LT Vol	35	1	21	2
Through Vol	0	95	90	0
RT Vol	9	37	3	0
Lane Flow Rate	48	145	124	2
Geometry Grp	1	1	1	1
Degree of Util (X)	0.061	0.157	0.142	0.003
Departure Headway (Hd)	4.613	3.916	4.119	4.731
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	781	906	862	761
Service Time	2.613	1.982	2.182	2.732
HCM Lane V/C Ratio	0.061	0.16	0.144	0.003
HCM Control Delay, s/veh	7.9	7.7	7.9	7.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.6	0.5	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	82	8	53	105	15	25
Future Volume (Veh/h)	82	8	53	105	15	25
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	89	9	58	114	16	27
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			98		324	94
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			98		324	94
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		98	97
cM capacity (veh/h)			1508		649	969

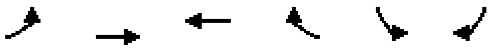
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	98	172	43
Volume Left	0	58	16
Volume Right	9	0	27
cSH	1700	1508	819
Volume to Capacity	0.06	0.04	0.05
Queue Length 95th (m)	0.0	0.9	1.3
Control Delay (s/veh)	0.0	2.7	9.6
Lane LOS		A	A
Approach Delay (s/veh)	0.0	2.7	9.6
Approach LOS			A

Intersection Summary			
Average Delay		2.8	
Intersection Capacity Utilization		25.1%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	202	139	204	116	82	290
Future Volume (Veh/h)	202	139	204	116	82	290
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	220	151	222	126	89	315
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	715	222			348	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	715	222			348	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	40	82			93	
cM capacity (veh/h)	366	820			1194	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	220	151	222	126	89	315
Volume Left	220	0	0	0	89	0
Volume Right	0	151	0	126	0	0
cSH	366	820	1700	1700	1194	1700
Volume to Capacity	0.60	0.18	0.13	0.07	0.07	0.19
Queue Length 95th (m)	28.5	5.1	0.0	0.0	1.8	0.0
Control Delay (s/veh)	28.5	10.4	0.0	0.0	8.3	0.0
Lane LOS	D	B			A	
Approach Delay (s/veh)	21.2		0.0		1.8	
Approach LOS	C					

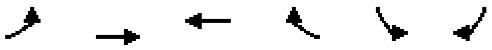
Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	119	101	24	14	14
Future Volume (Veh/h)	24	119	101	24	14	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	129	110	26	15	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	136				304	123
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	136				304	123
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	98
cM capacity (veh/h)	1448				675	928

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	155	136	30
Volume Left	26	0	15
Volume Right	0	26	15
cSH	1448	1700	782
Volume to Capacity	0.02	0.08	0.04
Queue Length 95th (m)	0.4	0.0	0.9
Control Delay (s/veh)	1.4	0.0	9.8
Lane LOS	A		A
Approach Delay (s/veh)	1.4	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	27.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	112	88	24	14	14
Future Volume (Veh/h)	24	112	88	24	14	14
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	122	96	26	15	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	122				283	109
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	122				283	109
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	98
cM capacity (veh/h)	1465				695	945

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	122	30
Volume Left	26	0	15
Volume Right	0	26	15
cSH	1465	1700	801
Volume to Capacity	0.02	0.07	0.04
Queue Length 95th (m)	0.4	0.0	0.9
Control Delay (s/veh)	1.4	0.0	9.7
Lane LOS	A		A
Approach Delay (s/veh)	1.4	0.0	9.7
Approach LOS			A

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

Arcady Outputs – Existing Conditions

Junctions 11

ARCADY 11 - Roundabout Module

Filename: Townline Rd_&_RR20_Existing Conditions.j11
Path: C:\Users\akamal\OneDrive - Stantec\Desktop\Projects\Smithville
Report generation date: 7/28/2025 2:33:29 PM

Summary of intersection performance

	AM							PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	Existing Conditions - 2025													
1 - St. Catharines Street		0.6	4.38	0.17	A	5.25	A		2.1	6.95	0.42	A	6.18	A
2 - Townline Road W		0.4	4.44	0.12	A				0.5	5.32	0.13	A		
3 - Regional Road 20		1.4	6.05	0.32	A				1.0	5.18	0.26	A		

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

File summary

File Description

Title	Existing Conditions
Location	
Site number	
Date	7/25/2025
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	CORP\akamal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Flows show original traffic demand (Veh/hr)

The intersection diagram reflects the last run of Intersections.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

HCM Calibration

HCM Calibration	Lane type	Num circulating lanes	Num exit lanes	A	B
1	Single lane	1		1380.00	-0.00102
2	Single lane	2		1420.00	-0.00085
3	Nearside	1		1420.00	-0.00091
4	Nearside	2		1420.00	-0.00085
5	Offside	1		1420.00	-0.00091
6	Offside	2		1350.00	-0.00092
7	Yielding bypass		1	1380.00	-0.00102
8	Yielding bypass		2	1420.00	-0.00085
9	Non-yielding bypass		1	99999.00	0.00000

Demand Set Summary

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Existing Conditions	2025	AM	PHF	08:00	09:00	15
D2	Existing Conditions	2025	PM	PHF	17:00	18:00	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

Existing Conditions | 2025 | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D1 - Existing Conditions | 2025 | AM	Demand Set 1: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3	5.25	A

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Right	Normal/unknown	5.25	A

Legs

Legs

Leg	Name	Description
1	St. Catharines Street	
2	Townline Road W	
3	Regional Road 20	

HCM Lanes

Leg	HCM Lane	Lane type	Number of conflicting lanes	Destination legs
1 - St. Catharines Street	1	Single lane	1	1, 2, 3
2 - Townline Road W	1	Single lane	1	1, 2, 3
3 - Regional Road 20	1	Single lane	1	1, 2, 3

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Existing Conditions	2025	AM	PHF	08:00	09:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - St. Catharines Street		✓	198	100.000
2 - Townline Road W		✓	124	100.000
3 - Regional Road 20		✓	344	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - St. Catharines Street	198	0.92	SecondQuarter
2 - Townline Road W	124	0.92	SecondQuarter
3 - Regional Road 20	344	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To		
		1 - St. Catharines Street	2 - Townline Road W	3 - Regional Road 20
From	1 - St. Catharines Street	0	32	166
	2 - Townline Road W	76	0	48
	3 - Regional Road 20	327	17	0

Vehicle Mix

Heavy Vehicle %

		To		
		1 - St. Catharines Street	2 - Townline Road W	3 - Regional Road 20
From	1 - St. Catharines Street	0	13	8
	2 - Townline Road W	8	0	0
	3 - Regional Road 20	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - St. Catharines Street	0.17	4.38	0.6	A
2 - Townline Road W	0.12	4.44	0.4	A
3 - Regional Road 20	0.32	6.05	1.4	A

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	187	16	0.00	1243	0.150	187	0.5	4.158	A
2 - Townline Road W	117	156	0.00	1107	0.105	117	0.4	4.162	A
3 - Regional Road 20	324	72	0.00	1193	0.272	324	1.1	5.496	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	215	18	0.00	1239	0.174	215	0.6	4.384	A
2 - Townline Road W	135	180	0.00	1078	0.125	135	0.4	4.440	A
3 - Regional Road 20	374	83	0.00	1179	0.317	374	1.4	6.053	A

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	204	17	0.00	1241	0.164	204	0.6	4.293	A
2 - Townline Road W	128	171	0.00	1090	0.117	128	0.4	4.326	A
3 - Regional Road 20	354	78	0.00	1184	0.299	354	1.3	5.824	A

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	187	16	0.00	1243	0.150	187	0.5	4.158	A
2 - Townline Road W	117	156	0.00	1107	0.105	117	0.4	4.162	A
3 - Regional Road 20	324	72	0.00	1193	0.272	324	1.1	5.496	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	187	187	0.00	16	1243	0.53	4.16	0.15	A
2 - Townline Road W	1	1, 2, 3	117	117	0.00	156	1107	0.35	4.16	0.11	A
3 - Regional Road 20	1	1, 2, 3	324	324	0.00	72	1193	1.11	5.50	0.27	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	215	215	0.00	18	1239	0.63	4.38	0.17	A
2 - Townline Road W	1	1, 2, 3	135	135	0.00	180	1078	0.43	4.44	0.12	A
3 - Regional Road 20	1	1, 2, 3	374	374	0.00	83	1179	1.37	6.05	0.32	A

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	204	204	0.00	17	1241	0.59	4.29	0.16	A
2 - Townline Road W	1	1, 2, 3	128	128	0.00	171	1090	0.40	4.33	0.12	A
3 - Regional Road 20	1	1, 2, 3	354	354	0.00	78	1184	1.26	5.82	0.30	A

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	187	187	0.00	16	1243	0.53	4.16	0.15	A
2 - Townline Road W	1	1, 2, 3	117	117	0.00	156	1107	0.35	4.16	0.11	A
3 - Regional Road 20	1	1, 2, 3	324	324	0.00	72	1193	1.11	5.50	0.27	A

Existing Conditions | 2025 | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D2 - Existing Conditions | 2025 | PM	Demand Set 2: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3	6.18	A

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Right	Normal/unknown	6.18	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Existing Conditions	2025	PM	PHF	17:00	18:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - St. Catharines Street		✓	499	100.000
2 - Townline Road W		✓	111	100.000
3 - Regional Road 20		✓	295	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - St. Catharines Street	499	0.92	SecondQuarter
2 - Townline Road W	111	0.92	SecondQuarter
3 - Regional Road 20	295	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To		
		1 - St. Catharines Street	2 - Townline Road W	3 - Regional Road 20
From	1 - St. Catharines Street	0	120	379
	2 - Townline Road W	70	0	41
	3 - Regional Road 20	250	45	0

Vehicle Mix

Heavy Vehicle %

		To		
		1 - St. Catharines Street	2 - Townline Road W	3 - Regional Road 20
From	1 - St. Catharines Street	0	0	3
	2 - Townline Road W	0	0	0
	3 - Regional Road 20	3	0	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - St. Catharines Street	0.42	6.95	2.1	A
2 - Townline Road W	0.13	5.32	0.5	A
3 - Regional Road 20	0.26	5.18	1.0	A

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	470	42	0.00	1292	0.364	470	1.7	6.189	A
2 - Townline Road W	105	357	0.00	948	0.110	105	0.4	4.817	A
3 - Regional Road 20	278	66	0.00	1258	0.221	278	0.8	4.775	A

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	542	49	0.00	1284	0.423	542	2.1	6.954	A
2 - Townline Road W	121	412	0.00	895	0.135	121	0.5	5.321	A
3 - Regional Road 20	321	76	0.00	1245	0.257	321	1.0	5.178	A

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	513	46	0.00	1287	0.399	513	2.0	6.636	A
2 - Townline Road W	114	390	0.00	916	0.125	114	0.4	5.112	A
3 - Regional Road 20	304	72	0.00	1250	0.243	304	1.0	5.013	A

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - St. Catharines Street	470	42	0.00	1292	0.364	470	1.7	6.189	A
2 - Townline Road W	105	357	0.00	948	0.110	105	0.4	4.817	A
3 - Regional Road 20	278	66	0.00	1258	0.221	278	0.8	4.775	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	470	470	0.00	42	1292	1.69	6.19	0.36	A
2 - Townline Road W	1	1, 2, 3	105	105	0.00	357	948	0.37	4.82	0.11	A
3 - Regional Road 20	1	1, 2, 3	278	278	0.00	66	1258	0.84	4.77	0.22	A

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	542	542	0.00	49	1284	2.15	6.95	0.42	A
2 - Townline Road W	1	1, 2, 3	121	121	0.00	412	895	0.47	5.32	0.13	A
3 - Regional Road 20	1	1, 2, 3	321	321	0.00	76	1245	1.03	5.18	0.26	A

Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	513	513	0.00	46	1287	1.95	6.64	0.40	A
2 - Townline Road W	1	1, 2, 3	114	114	0.00	390	916	0.43	5.11	0.12	A
3 - Regional Road 20	1	1, 2, 3	304	304	0.00	72	1250	0.95	5.01	0.24	A

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - St. Catharines Street	1	1, 2, 3	470	470	0.00	42	1292	1.69	6.19	0.36	A
2 - Townline Road W	1	1, 2, 3	105	105	0.00	357	948	0.37	4.82	0.11	A
3 - Regional Road 20	1	1, 2, 3	278	278	0.00	66	1258	0.84	4.77	0.22	A

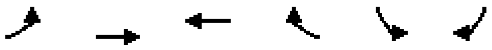
APPENDIX F

Synchro Outputs – Future Background Conditions (2030)

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	165	20	110	239	46	213
Future Volume (Veh/h)	165	20	110	239	46	213
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	179	22	120	260	50	232
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			201		690	190
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			201		690	190
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			91		86	72
cM capacity (veh/h)			1308		364	837

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	201	380	282
Volume Left	0	120	50
Volume Right	22	0	232
cSH	1700	1308	680
Volume to Capacity	0.12	0.09	0.41
Queue Length 95th (m)	0.0	2.3	15.5
Control Delay (s/veh)	0.0	3.1	14.0
Lane LOS		A	B
Approach Delay (s/veh)	0.0	3.1	14.0
Approach LOS			B

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	211	170	203	128	47	145
Future Volume (vph)	211	170	203	128	47	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	229	185	221	139	51	158

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	414	360	209
Volume Left (vph)	229	0	51
Volume Right (vph)	0	139	158
Hadj (s)	0.32	-0.07	-0.33
Departure Headway (s)	5.3	5.0	5.5
Degree Utilization, x	0.61	0.50	0.32
Capacity (veh/h)	653	686	587
Control Delay (s/veh)	16.4	13.1	11.1
Approach Delay (s/veh)	16.4	13.1	11.1
Approach LOS	C	B	B

Intersection Summary			
Delay	14.1		
Level of Service	B		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	211	170	203	128	47	145
Future Vol, veh/h	211	170	203	128	47	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	6	20	10	9	0	6
Mvmt Flow	229	185	221	139	51	158
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	15.7	13	10.9
HCM LOS	C	B	B

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	55%	0%	24%
Vol Thru, %	45%	61%	0%
Vol Right, %	0%	39%	76%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	381	331	192
LT Vol	211	0	47
Through Vol	170	203	0
RT Vol	0	128	145
Lane Flow Rate	414	360	209
Geometry Grp	1	1	1
Degree of Util (X)	0.6	0.5	0.313
Departure Headway (Hd)	5.215	5.005	5.394
Convergence, Y/N	Yes	Yes	Yes
Cap	696	720	666
Service Time	3.215	3.034	3.432
HCM Lane V/C Ratio	0.595	0.5	0.314
HCM Control Delay, s/veh	15.7	13	10.9
HCM Lane LOS	C	B	B
HCM 95th-tile Q	4	2.8	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	239	25	23	205	0	62	0	49	2	1	1
Future Volume (vph)	2	239	25	23	205	0	62	0	49	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	260	27	25	223	0	67	0	53	2	1	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	289	248	120	4
Volume Left (vph)	2	25	67	2
Volume Right (vph)	27	0	53	1
Hadj (s)	0.19	0.19	-0.08	0.38
Departure Headway (s)	4.7	4.8	5.1	5.8
Degree Utilization, x	0.38	0.33	0.17	0.01
Capacity (veh/h)	739	724	642	548
Control Delay (s/veh)	10.6	10.1	9.2	8.8
Approach Delay (s/veh)	10.6	10.1	9.2	8.8
Approach LOS	B	B	A	A

Intersection Summary				
Delay	10.1			
Level of Service	B			
Intersection Capacity Utilization	41.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	299	10	10	216	11	55
Future Volume (Veh/h)	299	10	10	216	11	55
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	325	11	11	235	12	60
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			336		588	331
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			336		588	331
tC, single (s)			4.2		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.8	3.3
p0 queue free %			99		97	92
cM capacity (veh/h)			1164		420	706

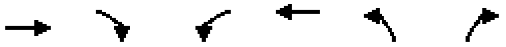
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	336	246	72
Volume Left	0	11	12
Volume Right	11	0	60
cSH	1700	1164	634
Volume to Capacity	0.20	0.01	0.11
Queue Length 95th (m)	0.0	0.2	2.9
Control Delay (s/veh)	0.0	0.4	11.4
Lane LOS		A	B
Approach Delay (s/veh)	0.0	0.4	11.4
Approach LOS			B

Intersection Summary			
Average Delay		1.4	
Intersection Capacity Utilization		30.2%	ICU Level of Service
Analysis Period (min)		15	

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	97	113	417	263	90	225
Future Volume (Veh/h)	97	113	417	263	90	225
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	105	123	453	286	98	245
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	894	453			739	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	894	453			739	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	61	79			88	
cM capacity (veh/h)	267	577			845	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	105	123	453	286	98	245
Volume Left	105	0	0	0	98	0
Volume Right	0	123	0	286	0	0
cSH	267	577	1700	1700	845	1700
Volume to Capacity	0.39	0.21	0.27	0.17	0.12	0.14
Queue Length 95th (m)	13.6	6.1	0.0	0.0	3.0	0.0
Control Delay (s/veh)	27.0	12.9	0.0	0.0	9.8	0.0
Lane LOS	D	B			A	
Approach Delay (s/veh)	19.4		0.0		2.8	
Approach LOS	C					

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	215	11	6	273	33	19
Future Volume (Veh/h)	215	11	6	273	33	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	234	12	7	297	36	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			246		551	240
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			246		551	240
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		93	97
cM capacity (veh/h)			1320		493	799

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	246	304	57
Volume Left	0	7	36
Volume Right	12	0	21
cSH	1700	1320	574
Volume to Capacity	0.14	0.01	0.10
Queue Length 95th (m)	0.0	0.1	2.5
Control Delay (s/veh)	0.0	0.2	12.0
Lane LOS		A	B
Approach Delay (s/veh)	0.0	0.2	12.0
Approach LOS			B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	222	6	12	253	3	17	0	36	9	0	9
Future Volume (Veh/h)	3	222	6	12	253	3	17	0	36	9	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	241	7	13	275	3	18	0	39	10	0	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	278			248			563	555	245	592	557	277
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	278			248			563	555	245	592	557	277
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	95	97	100	99
cM capacity (veh/h)	1285			1318			427	435	794	394	434	762

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	251	291	57	20
Volume Left	3	13	18	10
Volume Right	7	3	39	10
cSH	1285	1318	625	519
Volume to Capacity	0.00	0.01	0.09	0.04
Queue Length 95th (m)	0.1	0.2	2.3	0.9
Control Delay (s/veh)	0.1	0.4	11.3	12.2
Lane LOS	A	A	B	B
Approach Delay (s/veh)	0.1	0.4	11.3	12.2
Approach LOS			B	B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.8%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	11
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	239	25	23	205	0	62	0	49	2	1	1
Future Vol, veh/h	2	239	25	23	205	0	62	0	49	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	50	15	6	11	10	0	8	0	0	0	100	0
Mvmt Flow	2	260	27	25	223	0	67	0	53	2	1	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.3	10.2	9.4	8.5
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	56%	1%	10%	50%
Vol Thru, %	0%	90%	90%	25%
Vol Right, %	44%	9%	0%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	111	266	228	4
LT Vol	62	2	23	2
Through Vol	0	239	205	1
RT Vol	49	25	0	1
Lane Flow Rate	121	289	248	4
Geometry Grp	1	1	1	1
Degree of Util (X)	0.175	0.426	0.331	0.006
Departure Headway (Hd)	5.219	5.308	4.805	5.381
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	684	677	746	659
Service Time	3.277	3.356	2.851	3.463
HCM Lane V/C Ratio	0.177	0.427	0.332	0.006
HCM Control Delay, s/veh	9.4	12.3	10.2	8.5
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.6	2.1	1.5	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	49	209	1	17	113
Future Volume (Veh/h)	3	49	209	1	17	113
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	53	227	1	18	123
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	387	228			228	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	387	228			228	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	93			99	
cM capacity (veh/h)	608	812			1340	

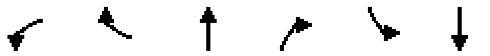
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	56	228	141
Volume Left	3	0	18
Volume Right	53	1	0
cSH	798	1700	1340
Volume to Capacity	0.07	0.13	0.01
Queue Length 95th (m)	1.7	0.0	0.3
Control Delay (s/veh)	9.9	0.0	1.1
Lane LOS	A		A
Approach Delay (s/veh)	9.9	0.0	1.1
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	49	161	1	17	99
Future Volume (Veh/h)	3	49	161	1	17	99
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	53	175	1	18	108
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	320	176			176	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	320	176			176	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			99	
cM capacity (veh/h)	665	868			1400	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	56	176	126
Volume Left	3	0	18
Volume Right	53	1	0
cSH	854	1700	1400
Volume to Capacity	0.07	0.10	0.01
Queue Length 95th (m)	1.6	0.0	0.3
Control Delay (s/veh)	9.5	0.0	1.2
Lane LOS	A		A
Approach Delay (s/veh)	9.5	0.0	1.2
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	49	112	1	17	85
Future Volume (Veh/h)	3	49	112	1	17	85
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	53	122	1	18	92
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	251	123			123	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	251	123			123	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			99	
cM capacity (veh/h)	729	929			1464	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	56	123	110
Volume Left	3	0	18
Volume Right	53	1	0
cSH	915	1700	1464
Volume to Capacity	0.06	0.07	0.01
Queue Length 95th (m)	1.5	0.0	0.3
Control Delay (s/veh)	9.2	0.0	1.3
Lane LOS	A		A
Approach Delay (s/veh)	9.2	0.0	1.3
Approach LOS	A		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	22.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	201	11	6	296	3	33	0	19	9	0	9
Future Volume (Veh/h)	3	201	11	6	296	3	33	0	19	9	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	218	12	7	322	3	36	0	21	10	0	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	325			230			578	569	224	589	574	324
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	325			230			578	569	224	589	574	324
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			91	100	97	98	100	99
cM capacity (veh/h)	1235			1338			419	429	815	407	426	717

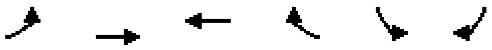
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	233	332	57	20
Volume Left	3	7	36	10
Volume Right	12	3	21	10
cSH	1235	1338	510	519
Volume to Capacity	0.00	0.01	0.11	0.04
Queue Length 95th (m)	0.1	0.1	2.8	0.9
Control Delay (s/veh)	0.1	0.2	12.9	12.2
Lane LOS	A	A	B	B
Approach Delay (s/veh)	0.1	0.2	12.9	12.2
Approach LOS			B	B

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	30.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	253	45	250	224	27	174
Future Volume (Veh/h)	253	45	250	224	27	174
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	275	49	272	243	29	189
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			324		1087	300
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			324		1087	300
tC, single (s)			4.2		6.6	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.7	3.4
p0 queue free %			77		83	74
cM capacity (veh/h)			1192		173	726

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	324	515	218
Volume Left	0	272	29
Volume Right	49	0	189
cSH	1700	1192	509
Volume to Capacity	0.19	0.23	0.43
Queue Length 95th (m)	0.0	6.7	16.1
Control Delay (s/veh)	0.0	5.8	17.3
Lane LOS		A	C
Approach Delay (s/veh)	0.0	5.8	17.3
Approach LOS			C

Intersection Summary			
Average Delay		6.4	
Intersection Capacity Utilization		63.9%	ICU Level of Service B
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	190	227	206	92	139	257
Future Volume (vph)	190	227	206	92	139	257
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	207	247	224	100	151	279

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	454	324	430
Volume Left (vph)	207	0	151
Volume Right (vph)	0	100	279
Hadj (s)	0.12	-0.17	-0.29
Departure Headway (s)	6.0	5.9	5.8
Degree Utilization, x	0.75	0.53	0.69
Capacity (veh/h)	584	565	591
Control Delay (s/veh)	24.8	15.4	20.8
Approach Delay (s/veh)	24.8	15.4	20.8
Approach LOS	C	C	C

Intersection Summary			
Delay	20.8		
Level of Service	C		
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	20.4
Intersection LOS	C

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	190	227	206	92	139	257
Future Vol, veh/h	190	227	206	92	139	257
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	3	1	1	0	0	3
Mvmt Flow	207	247	224	100	151	279
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	24.2	15.2	20.3
HCM LOS	C	C	C

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	0%	35%
Vol Thru, %	54%	69%	0%
Vol Right, %	0%	31%	65%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	417	298	396
LT Vol	190	0	139
Through Vol	227	206	0
RT Vol	0	92	257
Lane Flow Rate	453	324	430
Geometry Grp	1	1	1
Degree of Util (X)	0.743	0.523	0.682
Departure Headway (Hd)	5.898	5.817	5.702
Convergence, Y/N	Yes	Yes	Yes
Cap	607	615	628
Service Time	3.978	3.908	3.781
HCM Lane V/C Ratio	0.746	0.527	0.685
HCM Control Delay, s/veh	24.2	15.2	20.3
HCM Lane LOS	C	C	C
HCM 95th-tile Q	6.5	3	5.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	266	63	61	287	4	54	0	33	2	0	0
Future Volume (vph)	1	266	63	61	287	4	54	0	33	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	289	68	66	312	4	59	0	36	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	358	382	95	2
Volume Left (vph)	1	66	59	2
Volume Right (vph)	68	4	36	0
Hadj (s)	-0.03	0.06	-0.04	0.20
Departure Headway (s)	4.6	4.6	5.5	6.0
Degree Utilization, x	0.46	0.49	0.15	0.00
Capacity (veh/h)	762	751	569	507
Control Delay (s/veh)	11.4	12.1	9.5	9.0
Approach Delay (s/veh)	11.4	12.1	9.5	9.0
Approach LOS	B	B	A	A

Intersection Summary				
Delay	11.5			
Level of Service	B			
Intersection Capacity Utilization	51.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	266	63	61	287	4	54	0	33	2	0	0
Future Vol, veh/h	1	266	63	61	287	4	54	0	33	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	5	5	0	2	0	6	0	0	0	0	0
Mvmt Flow	1	289	68	66	312	4	59	0	36	2	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.1	11.9	9.5	9
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	62%	0%	17%	100%
Vol Thru, %	0%	81%	82%	0%
Vol Right, %	38%	19%	1%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	87	330	352	2
LT Vol	54	1	61	2
Through Vol	0	266	287	0
RT Vol	33	63	4	0
Lane Flow Rate	95	359	383	2
Geometry Grp	1	1	1	1
Degree of Util (X)	0.145	0.445	0.486	0.004
Departure Headway (Hd)	5.507	4.469	4.574	5.897
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	647	803	784	601
Service Time	3.58	2.513	2.619	3.989
HCM Lane V/C Ratio	0.147	0.447	0.489	0.003
HCM Control Delay, s/veh	9.5	11.1	11.9	9
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.5	2.3	2.7	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	273	10	63	341	18	30
Future Volume (Veh/h)	273	10	63	341	18	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	297	11	68	371	20	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			308		810	303
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			308		810	303
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		94	96
cM capacity (veh/h)			1264		333	742

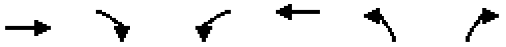
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	308	439	53
Volume Left	0	68	20
Volume Right	11	0	33
cSH	1700	1264	507
Volume to Capacity	0.18	0.05	0.10
Queue Length 95th (m)	0.0	1.3	2.6
Control Delay (s/veh)	0.0	1.7	12.9
Lane LOS		A	B
Approach Delay (s/veh)	0.0	1.7	12.9
Approach LOS			B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	314	198	337	187	151	502
Future Volume (Veh/h)	314	198	337	187	151	502
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	341	215	366	203	164	546
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1240	366			569	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1240	366			569	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	68			83	
cM capacity (veh/h)	161	681			989	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	341	215	366	203	164	546
Volume Left	341	0	0	0	164	0
Volume Right	0	215	0	203	0	0
cSH	161	681	1700	1700	989	1700
Volume to Capacity	2.12	0.32	0.22	0.12	0.17	0.32
Queue Length 95th (m)	207.1	10.3	0.0	0.0	4.5	0.0
Control Delay (s/veh)	572.4	12.7	0.0	0.0	9.4	0.0
Lane LOS	F	B			A	
Approach Delay (s/veh)	356.0		0.0		2.2	
Approach LOS	F					

Intersection Summary			
Average Delay	108.7		
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	316	35	21	282	21	13
Future Volume (Veh/h)	316	35	21	282	21	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	343	38	23	307	23	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			381		715	362
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			381		715	362
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		94	98
cM capacity (veh/h)			1177		390	683

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	381	330	37
Volume Left	0	23	23
Volume Right	38	0	14
cSH	1700	1177	465
Volume to Capacity	0.22	0.02	0.08
Queue Length 95th (m)	0.0	0.5	2.0
Control Delay (s/veh)	0.0	0.7	13.4
Lane LOS		A	B
Approach Delay (s/veh)	0.0	0.7	13.4
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	292	19	36	277	29	12	0	22	17	0	17
Future Volume (Veh/h)	29	292	19	36	277	29	12	0	22	17	0	17
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	317	21	39	301	32	13	0	24	18	0	18
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	333			338			805	803	328	811	797	317
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	333			338			805	803	328	811	797	317
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			97			95	100	97	93	100	98
cM capacity (veh/h)	1226			1221			281	299	714	276	301	724

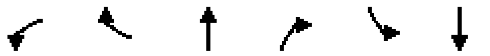
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	370	372	37	36
Volume Left	32	39	13	18
Volume Right	21	32	24	18
cSH	1226	1221	463	399
Volume to Capacity	0.03	0.03	0.08	0.09
Queue Length 95th (m)	0.6	0.8	2.0	2.2
Control Delay (s/veh)	0.9	1.1	13.5	14.9
Lane LOS	A	A	B	B
Approach Delay (s/veh)	0.9	1.1	13.5	14.9
Approach LOS			B	B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	33	168	3	53	242
Future Volume (Veh/h)	2	33	168	3	53	242
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	36	183	3	58	263
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	564	185			186	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	564	185			186	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			96	
cM capacity (veh/h)	467	858			1388	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	186	321
Volume Left	2	0	58
Volume Right	36	3	0
cSH	822	1700	1388
Volume to Capacity	0.05	0.11	0.04
Queue Length 95th (m)	1.1	0.0	1.0
Control Delay (s/veh)	9.6	0.0	1.7
Lane LOS	A		A
Approach Delay (s/veh)	9.6	0.0	1.7
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	33	137	3	53	191
Future Volume (Veh/h)	2	33	137	3	53	191
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	36	149	3	58	208
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	475	151			152	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	475	151			152	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			96	
cM capacity (veh/h)	526	896			1429	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	152	266
Volume Left	2	0	58
Volume Right	36	3	0
cSH	864	1700	1429
Volume to Capacity	0.04	0.09	0.04
Queue Length 95th (m)	1.0	0.0	1.0
Control Delay (s/veh)	9.4	0.0	1.9
Lane LOS	A		A
Approach Delay (s/veh)	9.4	0.0	1.9
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	33	107	3	53	139
Future Volume (Veh/h)	2	33	107	3	53	139
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	36	116	3	58	151
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	385	118			119	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	385	118			119	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			96	
cM capacity (veh/h)	594	934			1469	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	119	209
Volume Left	2	0	58
Volume Right	36	3	0
cSH	907	1700	1469
Volume to Capacity	0.04	0.07	0.04
Queue Length 95th (m)	1.0	0.0	0.9
Control Delay (s/veh)	9.1	0.0	2.3
Lane LOS	A		A
Approach Delay (s/veh)	9.1	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	26.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	311	35	21	251	29	21	0	13	17	0	17
Future Volume (Veh/h)	29	311	35	21	251	29	21	0	13	17	0	17
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	338	38	23	273	32	23	0	14	18	0	18
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	305			376			774	772	357	770	775	289
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	305			376			774	772	357	770	775	289
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			92	100	98	94	100	98
cM capacity (veh/h)	1256			1182			298	316	687	301	314	750

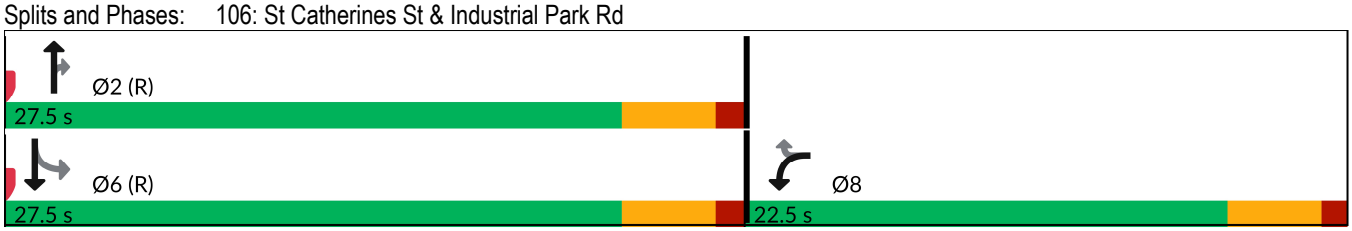
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	408	328	37	36
Volume Left	32	23	23	18
Volume Right	38	32	14	18
cSH	1256	1182	379	429
Volume to Capacity	0.03	0.02	0.10	0.08
Queue Length 95th (m)	0.6	0.5	2.4	2.1
Control Delay (s/veh)	0.9	0.7	15.5	14.2
Lane LOS	A	A	C	B
Approach Delay (s/veh)	0.9	0.7	15.5	14.2
Approach LOS			C	B

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	36.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	314	198	337	187	151	502
Future Volume (vph)	314	198	337	187	151	502
Satd. Flow (prot)	1772	1617	1847	1484	1738	1830
Flt Permitted	0.950				0.487	
Satd. Flow (perm)	1772	1617	1847	1484	891	1830
Satd. Flow (RTOR)		215		203		
Adj. Flow (vph)	341	215	366	203	164	546
Lane Group Flow (vph)	341	215	366	203	164	546
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	22.5	22.5	27.5	27.5	27.5	27.5
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.0	18.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.36	0.36	0.46	0.46	0.46	0.46
v/c Ratio	0.54	0.30	0.43	0.26	0.40	0.65
Control Delay (s/veh)	16.5	3.4	11.1	2.5	12.7	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	16.5	3.4	11.1	2.5	12.7	14.9
LOS	B	A	B	A	B	B
Approach Delay (s/veh)	11.4		8.0			14.4
Approach LOS	B		A			B
Queue Length 50th (m)	23.2	0.0	20.3	0.0	8.9	34.5
Queue Length 95th (m)	42.5	10.0	36.6	7.9	21.0	60.9
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	30.0			55.0	100.0	
Base Capacity (vph)	637	719	849	792	409	841
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.30	0.43	0.26	0.40	0.65

Intersection Summary		
Cycle Length: 50		
Actuated Cycle Length: 50		
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green		
Control Type: Pretimed		
Maximum v/c Ratio: 0.65		
Intersection Signal Delay (s/veh): 11.5	Intersection LOS: B	
Intersection Capacity Utilization 54.7%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 106: St Catherines St & Industrial Park Rd



APPENDIX G

Arcady Outputs – Future Background Conditions (2030)

Junctions 11

ARCADY 11 - Roundabout Module

Filename: Townline Rd_&_RR20_Future Background (R2).j11
Path: C:\Users\akamal\OneDrive - Stantec\Desktop\Projects\Smithville
Report generation date: 7/28/2025 2:30:31 PM

Summary of intersection performance

	AM							PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	Future Background - 2030													
1 - Access Road		2.0	11.32	0.41	B	9.20	A		0.9	7.77	0.24	A	16.33	C
2 - St. Catharines Street		1.4	6.85	0.33	A				10.4	21.83	0.84	C		
3 - Townline Road W		1.9	8.51	0.40	A				2.7	12.70	0.49	B		
4 - Regional Road 20		3.1	10.19	0.52	B				4.0	12.16	0.59	B		

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

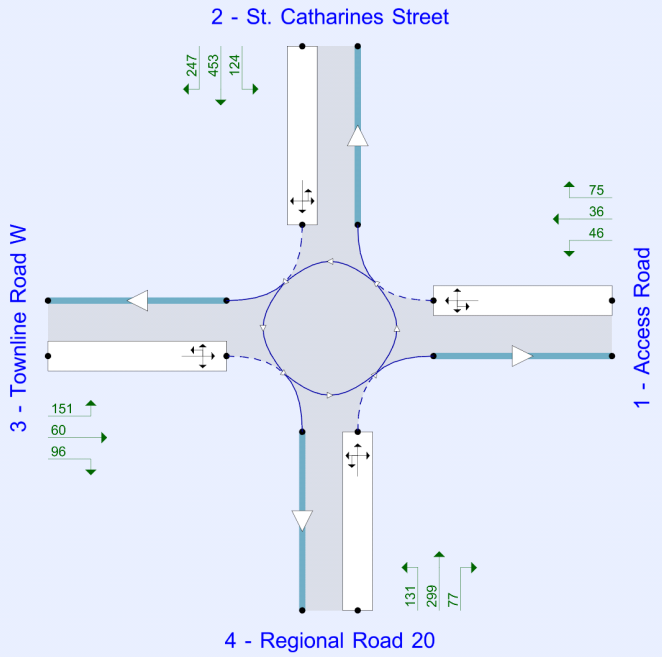
File summary

File Description

Title	Future Background (2030)
Location	
Site number	
Date	7/25/2025
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	CORP\akamal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



Flows show original traffic demand (Veh/hr)

The intersection diagram reflects the last run of Intersections.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

HCM Calibration

HCM Calibration	Lane type	Num circulating lanes	Num exit lanes	A	B
1	Single lane	1		1380.00	-0.00102
2	Single lane	2		1420.00	-0.00085
3	Nearside	1		1420.00	-0.00091
4	Nearside	2		1420.00	-0.00085
5	Offside	1		1420.00	-0.00091
6	Offside	2		1350.00	-0.00092
7	Yielding bypass		1	1380.00	-0.00102
8	Yielding bypass		2	1420.00	-0.00085
9	Non-yielding bypass		1	99999.00	0.00000

Demand Set Summary

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Future Background	2030	AM	PHF	08:00	09:00	15
D2	Future Background	2030	PM	PHF	17:00	18:00	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

Future Background | 2030 | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D1 - Future Background | 2030 | AM	Demand Set 1: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3, 4	9.20	A

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Right	Normal/unknown	9.20	A

Legs

Legs

Leg	Name	Description
1	Access Road	
2	St. Catharines Street	
3	Townline Road W	
4	Regional Road 20	

HCM Lanes

Leg	HCM Lane	Lane type	Number of conflicting lanes	Destination legs
1 - Access Road	1	Single lane	1	1, 2, 3, 4
2 - St. Catharines Street	1	Single lane	1	1, 2, 3, 4
3 - Townline Road W	1	Single lane	1	1, 2, 3, 4
4 - Regional Road 20	1	Single lane	1	1, 2, 3, 4

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Future Background	2030	AM	PHF	08:00	09:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - Access Road		✓	252	100.000
2 - St. Catharines Street		✓	308	100.000
3 - Townline Road W		✓	336	100.000
4 - Regional Road 20		✓	465	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - Access Road	252	0.92	SecondQuarter
2 - St. Catharines Street	308	0.92	SecondQuarter
3 - Townline Road W	336	0.92	SecondQuarter
4 - Regional Road 20	465	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	113	58	81
	2 - St. Catharines Street	38	0	72	198
	3 - Townline Road W	19	177	0	140
	4 - Regional Road 20	27	390	48	0

Vehicle Mix

Heavy Vehicle %

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	0	0	0
	2 - St. Catharines Street	0	0	13	8
	3 - Townline Road W	0	8	0	0
	4 - Regional Road 20	0	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - Access Road	0.41	11.32	2.0	B
2 - St. Catharines Street	0.33	6.85	1.4	A
3 - Townline Road W	0.40	8.51	1.9	A
4 - Regional Road 20	0.52	10.19	3.1	B

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	237	579	0.00	729	0.326	237	1.4	8.932	A
2 - St. Catharines Street	290	176	0.00	1054	0.275	290	1.1	6.083	A
3 - Townline Road W	317	299	0.00	962	0.329	317	1.4	7.214	A
4 - Regional Road 20	438	220	0.00	1011	0.433	438	2.2	8.417	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	274	668	0.00	661	0.414	274	2.0	11.321	B
2 - St. Catharines Street	335	203	0.00	1024	0.327	335	1.4	6.852	A
3 - Townline Road W	365	345	0.00	916	0.399	365	1.9	8.511	A
4 - Regional Road 20	505	254	0.00	975	0.518	505	3.1	10.191	B

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	259	633	0.00	687	0.377	259	1.8	10.261	B
2 - St. Catharines Street	317	192	0.00	1036	0.306	317	1.3	6.531	A
3 - Townline Road W	346	326	0.00	934	0.370	346	1.7	7.956	A
4 - Regional Road 20	478	241	0.00	989	0.484	478	2.7	9.418	A

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	237	579	0.00	729	0.326	237	1.4	8.932	A
2 - St. Catharines Street	290	176	0.00	1054	0.275	290	1.1	6.083	A
3 - Townline Road W	317	299	0.00	962	0.329	317	1.4	7.214	A
4 - Regional Road 20	438	220	0.00	1011	0.433	438	2.2	8.417	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	237	237	0.00	579	729	1.42	8.93	0.33	A
2 - St. Catharines Street	1	1, 2, 3, 4	290	290	0.00	176	1054	1.13	6.08	0.28	A
3 - Townline Road W	1	1, 2, 3, 4	317	317	0.00	299	962	1.45	7.21	0.33	A
4 - Regional Road 20	1	1, 2, 3, 4	438	438	0.00	220	1011	2.22	8.42	0.43	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	274	274	0.00	668	661	2.04	11.32	0.41	B
2 - St. Catharines Street	1	1, 2, 3, 4	335	335	0.00	203	1024	1.43	6.85	0.33	A
3 - Townline Road W	1	1, 2, 3, 4	365	365	0.00	345	916	1.94	8.51	0.40	A
4 - Regional Road 20	1	1, 2, 3, 4	505	505	0.00	254	975	3.07	10.19	0.52	B

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	259	259	0.00	633	687	1.76	10.26	0.38	B
2 - St. Catharines Street	1	1, 2, 3, 4	317	317	0.00	192	1036	1.30	6.53	0.31	A
3 - Townline Road W	1	1, 2, 3, 4	346	346	0.00	326	934	1.72	7.96	0.37	A
4 - Regional Road 20	1	1, 2, 3, 4	478	478	0.00	241	989	2.70	9.42	0.48	A

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	**1**	1, 2, 3, 4	237	237	0.00	579	729	1.42	8.93	0.33	A
2 - St. Catharines Street	**1**	1, 2, 3, 4	290	290	0.00	176	1054	1.13	6.08	0.28	A
3 - Townline Road W	**1**	1, 2, 3, 4	317	317	0.00	299	962	1.45	7.21	0.33	A
4 - Regional Road 20	**1**	1, 2, 3, 4	438	438	0.00	220	1011	2.22	8.42	0.43	A

Future Background | 2030 | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D2 - Future Background | 2030 | PM	Demand Set 2: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3, 4	16.33	C

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Right	Normal/unknown	16.33	C

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Future Background	2030	PM	PHF	17:00	18:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - Access Road		✓	157	100.000
2 - St. Catharines Street		✓	824	100.000
3 - Townline Road W		✓	307	100.000
4 - Regional Road 20		✓	507	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - Access Road	157	0.92	SecondQuarter
2 - St. Catharines Street	824	0.92	SecondQuarter
3 - Townline Road W	307	0.92	SecondQuarter
4 - Regional Road 20	507	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	75	36	46
	2 - St. Catharines Street	124	0	247	453
	3 - Townline Road W	60	151	0	96
	4 - Regional Road 20	77	299	131	0

Vehicle Mix

Heavy Vehicle %

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	0	0	0
	2 - St. Catharines Street	0	0	0	3
	3 - Townline Road W	0	0	0	0
	4 - Regional Road 20	0	3	0	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - Access Road	0.24	7.77	0.9	A
2 - St. Catharines Street	0.84	21.83	10.4	C
3 - Townline Road W	0.49	12.70	2.7	B
4 - Regional Road 20	0.59	12.16	4.0	B

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	148	547	0.00	783	0.189	148	0.7	6.611	A
2 - St. Catharines Street	776	201	0.00	1106	0.702	776	6.1	14.021	B
3 - Townline Road W	289	587	0.00	749	0.386	289	1.8	9.736	A
4 - Regional Road 20	478	316	0.00	983	0.486	478	2.7	9.505	A

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	171	632	0.00	717	0.238	171	0.9	7.766	A
2 - St. Catharines Street	896	232	0.00	1072	0.835	896	10.4	21.827	C
3 - Townline Road W	334	677	0.00	681	0.490	334	2.7	12.697	B
4 - Regional Road 20	551	364	0.00	935	0.589	551	4.0	12.160	B

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	162	598	0.00	743	0.217	162	0.8	7.274	A
2 - St. Catharines Street	848	219	0.00	1086	0.781	848	8.4	17.891	C
3 - Townline Road W	316	641	0.00	707	0.447	316	2.3	11.361	B
4 - Regional Road 20	522	345	0.00	954	0.547	522	3.4	10.964	B

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	148	547	0.00	783	0.189	148	0.7	6.611	A
2 - St. Catharines Street	776	201	0.00	1106	0.702	776	6.1	14.021	B
3 - Townline Road W	289	587	0.00	749	0.386	289	1.8	9.736	A
4 - Regional Road 20	478	316	0.00	983	0.486	478	2.7	9.505	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	148	148	0.00	547	783	0.69	6.61	0.19	A
2 - St. Catharines Street	1	1, 2, 3, 4	776	776	0.00	201	1106	6.14	14.02	0.70	B
3 - Townline Road W	1	1, 2, 3, 4	289	289	0.00	587	749	1.83	9.74	0.39	A
4 - Regional Road 20	1	1, 2, 3, 4	478	478	0.00	316	983	2.72	9.51	0.49	A

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	171	171	0.00	632	717	0.92	7.77	0.24	A
2 - St. Catharines Street	1	1, 2, 3, 4	896	896	0.00	232	1072	10.36	21.83	0.84	C
3 - Townline Road W	1	1, 2, 3, 4	334	334	0.00	677	681	2.71	12.70	0.49	B
4 - Regional Road 20	1	1, 2, 3, 4	551	551	0.00	364	935	3.97	12.16	0.59	B

Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	162	162	0.00	598	743	0.82	7.27	0.22	A
2 - St. Catharines Street	1	1, 2, 3, 4	848	848	0.00	219	1086	8.35	17.89	0.78	C
3 - Townline Road W	1	1, 2, 3, 4	316	316	0.00	641	707	2.31	11.36	0.45	B
4 - Regional Road 20	1	1, 2, 3, 4	522	522	0.00	345	954	3.41	10.96	0.55	B

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	148	148	0.00	547	783	0.69	6.61	0.19	A
2 - St. Catharines Street	1	1, 2, 3, 4	776	776	0.00	201	1106	6.14	14.02	0.70	B
3 - Townline Road W	1	1, 2, 3, 4	289	289	0.00	587	749	1.83	9.74	0.39	A
4 - Regional Road 20	1	1, 2, 3, 4	478	478	0.00	316	983	2.72	9.51	0.49	A

APPENDIX H

Traffic Signal Warrant – Future Background Conditions (2030)

Intersection:	Industrial Park Rd @ Regional Road 20
Major Street:	North-South — Lanes: 1
Minor Street:	East-West — Lanes: 1
Urban/Rural:	Urban
Legs:	3
New/Existing Intersection:	existing
Scenario:	2030 Background

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AmPHV	0	417	263	90	225	0	0	0	0	97	0	113
PmPHV	0	337	187	151	502	0	0	0	0	314	0	198
AHV	0	189	113	60	182	0	0	0	0	103	0	78

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	814	113%	113%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	271	159%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	543	129%	129%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	103	137%		

Notes:

1. Refer to OTM Book 12, pg 92, March 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PHV/2 or (AM + PM) / 4

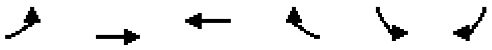
APPENDIX I

Synchro Outputs – Future Total Conditions (2030)

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	170	20	110	253	46	213
Future Volume (Veh/h)	170	20	110	253	46	213
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	185	22	120	275	50	232
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			207		711	196
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			207		711	196
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			91		86	72
cM capacity (veh/h)			1301		353	830

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	207	395	282
Volume Left	0	120	50
Volume Right	22	0	232
cSH	1700	1301	670
Volume to Capacity	0.12	0.09	0.42
Queue Length 95th (m)	0.0	2.3	15.9
Control Delay (s/veh)	0.0	3.1	14.2
Lane LOS		A	B
Approach Delay (s/veh)	0.0	3.1	14.2
Approach LOS			B

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	211	175	217	161	58	145
Future Volume (vph)	211	175	217	161	58	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	229	190	236	175	63	158

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	419	411	221
Volume Left (vph)	229	0	63
Volume Right (vph)	0	175	158
Hadj (s)	0.32	-0.09	-0.30
Departure Headway (s)	5.5	5.1	5.7
Degree Utilization, x	0.64	0.58	0.35
Capacity (veh/h)	636	681	569
Control Delay (s/veh)	17.6	15.0	11.7
Approach Delay (s/veh)	17.6	15.0	11.7
Approach LOS	C	C	B

Intersection Summary			
Delay	15.3		
Level of Service	C		
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	14.9
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	211	175	217	161	58	145
Future Vol, veh/h	211	175	217	161	58	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	6	20	10	9	0	6
Mvmt Flow	229	190	236	175	63	158
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	16.7	14.8	11.5
HCM LOS	C	B	B

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	55%	0%	29%
Vol Thru, %	45%	57%	0%
Vol Right, %	0%	43%	71%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	386	378	203
LT Vol	211	0	58
Through Vol	175	217	0
RT Vol	0	161	145
Lane Flow Rate	420	411	221
Geometry Grp	1	1	1
Degree of Util (X)	0.62	0.578	0.342
Departure Headway (Hd)	5.32	5.061	5.573
Convergence, Y/N	Yes	Yes	Yes
Cap	680	715	644
Service Time	3.354	3.094	3.616
HCM Lane V/C Ratio	0.618	0.575	0.343
HCM Control Delay, s/veh	16.7	14.8	11.5
HCM Lane LOS	C	B	B
HCM 95th-tile Q	4.3	3.7	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	297	25	23	224	0	62	0	49	2	1	1
Future Volume (vph)	2	297	25	23	224	0	62	0	49	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	323	27	25	243	0	67	0	53	2	1	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	352	268	120	4
Volume Left (vph)	2	25	67	2
Volume Right (vph)	27	0	53	1
Hadj (s)	0.20	0.19	-0.08	0.38
Departure Headway (s)	4.8	4.9	5.3	6.0
Degree Utilization, x	0.47	0.36	0.18	0.01
Capacity (veh/h)	733	711	612	517
Control Delay (s/veh)	11.9	10.6	9.5	9.0
Approach Delay (s/veh)	11.9	10.6	9.5	9.0
Approach LOS	B	B	A	A

Intersection Summary				
Delay	11.0			
Level of Service	B			
Intersection Capacity Utilization	43.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	12.2
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	297	25	23	224	0	62	0	49	2	1	1
Future Vol, veh/h	2	297	25	23	224	0	62	0	49	2	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	50	15	6	11	10	0	8	0	0	0	100	0
Mvmt Flow	2	323	27	25	243	0	67	0	53	2	1	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	14.2	10.8	9.7	8.8
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	56%	1%	9%	50%
Vol Thru, %	0%	92%	91%	25%
Vol Right, %	44%	8%	0%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	111	324	247	4
LT Vol	62	2	23	2
Through Vol	0	297	224	1
RT Vol	49	25	0	1
Lane Flow Rate	121	352	268	4
Geometry Grp	1	1	1	1
Degree of Util (X)	0.182	0.524	0.365	0.007
Departure Headway (Hd)	5.428	5.356	4.898	5.715
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	656	669	730	630
Service Time	3.503	3.414	2.957	3.715
HCM Lane V/C Ratio	0.184	0.526	0.367	0.006
HCM Control Delay, s/veh	9.7	14.2	10.8	8.8
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.7	3.1	1.7	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	357	10	10	235	11	55
Future Volume (Veh/h)	357	10	10	235	11	55
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	388	11	11	255	12	60
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			399		671	394
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			399		671	394
tC, single (s)			4.2		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.8	3.3
p0 queue free %			99		97	91
cM capacity (veh/h)			1102		374	651

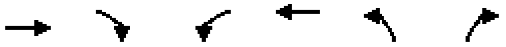
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	399	266	72
Volume Left	0	11	12
Volume Right	11	0	60
cSH	1700	1102	579
Volume to Capacity	0.23	0.01	0.12
Queue Length 95th (m)	0.0	0.2	3.2
Control Delay (s/veh)	0.0	0.4	12.1
Lane LOS		A	B
Approach Delay (s/veh)	0.0	0.4	12.1
Approach LOS			B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	102	113	435	278	90	231
Future Volume (Veh/h)	102	113	435	278	90	231
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	111	123	473	302	98	251
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	920	473			775	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	920	473			775	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	57	78			88	
cM capacity (veh/h)	256	562			819	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	111	123	473	302	98	251
Volume Left	111	0	0	0	98	0
Volume Right	0	123	0	302	0	0
cSH	256	562	1700	1700	819	1700
Volume to Capacity	0.43	0.22	0.28	0.18	0.12	0.15
Queue Length 95th (m)	15.7	6.3	0.0	0.0	3.1	0.0
Control Delay (s/veh)	29.4	13.2	0.0	0.0	10.0	0.0
Lane LOS	D	B			A	
Approach Delay (s/veh)	20.9		0.0		2.8	
Approach LOS	C					

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	220	22	13	288	65	39
Future Volume (Veh/h)	220	22	13	288	65	39
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	239	24	14	313	71	42
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			263		592	251
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			263		592	251
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		85	95
cM capacity (veh/h)			1301		464	788

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	263	327	113
Volume Left	0	14	71
Volume Right	24	0	42
cSH	1700	1301	548
Volume to Capacity	0.15	0.01	0.21
Queue Length 95th (m)	0.0	0.2	5.8
Control Delay (s/veh)	0.0	0.4	13.3
Lane LOS		A	B
Approach Delay (s/veh)	0.0	0.4	13.3
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	242	11	25	260	3	32	0	74	9	0	9
Future Volume (Veh/h)	3	242	11	25	260	3	32	0	74	9	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	263	12	27	283	3	35	0	80	10	0	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	286			275			624	615	269	694	620	285
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	286			275			624	615	269	694	620	285
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			91	100	90	97	100	99
cM capacity (veh/h)	1276			1288			386	397	770	315	395	754

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	278	313	115	20
Volume Left	3	27	35	10
Volume Right	12	3	80	10
cSH	1276	1288	591	444
Volume to Capacity	0.00	0.02	0.19	0.05
Queue Length 95th (m)	0.1	0.5	5.4	1.1
Control Delay (s/veh)	0.1	0.9	12.6	13.5
Lane LOS	A	A	B	B
Approach Delay (s/veh)	0.1	0.9	12.6	13.5
Approach LOS			B	B

Intersection Summary				
Average Delay	2.8			
Intersection Capacity Utilization	43.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	49	209	2	17	113
Future Volume (Veh/h)	6	49	209	2	17	113
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	53	227	2	18	123
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	387	228			229	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	387	228			229	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	93			99	
cM capacity (veh/h)	608	811			1339	

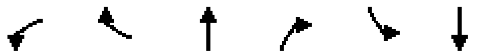
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	60	229	141
Volume Left	7	0	18
Volume Right	53	2	0
cSH	781	1700	1339
Volume to Capacity	0.08	0.13	0.01
Queue Length 95th (m)	1.9	0.0	0.3
Control Delay (s/veh)	10.0	0.0	1.1
Lane LOS	A		A
Approach Delay (s/veh)	10.0	0.0	1.1
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	6	49	162	2	17	102
Future Volume (Veh/h)	6	49	162	2	17	102
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	53	176	2	18	111
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	324	177			178	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	324	177			178	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	94			99	
cM capacity (veh/h)	661	866			1398	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	60	178	129
Volume Left	7	0	18
Volume Right	53	2	0
cSH	836	1700	1398
Volume to Capacity	0.07	0.10	0.01
Queue Length 95th (m)	1.8	0.0	0.3
Control Delay (s/veh)	9.6	0.0	1.2
Lane LOS	A		A
Approach Delay (s/veh)	9.6	0.0	1.2
Approach LOS	A		

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	49	114	1	17	91
Future Volume (Veh/h)	3	49	114	1	17	91
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	53	124	1	18	99
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	260	125			125	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	260	125			125	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	94			99	
cM capacity (veh/h)	720	926			1462	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	56	125	117
Volume Left	3	0	18
Volume Right	53	1	0
cSH	912	1700	1462
Volume to Capacity	0.06	0.07	0.01
Queue Length 95th (m)	1.5	0.0	0.3
Control Delay (s/veh)	9.2	0.0	1.2
Lane LOS	A		A
Approach Delay (s/veh)	9.2	0.0	1.2
Approach LOS	A		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	217	11	6	343	3	33	0	19	9	0	9
Future Volume (Veh/h)	3	217	11	6	343	3	33	0	19	9	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	236	12	7	373	3	36	0	21	10	0	10
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	376			248			647	638	242	658	643	375
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	376			248			647	638	242	658	643	375
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			90	100	97	97	100	99
cM capacity (veh/h)	1182			1318			376	391	797	366	389	672

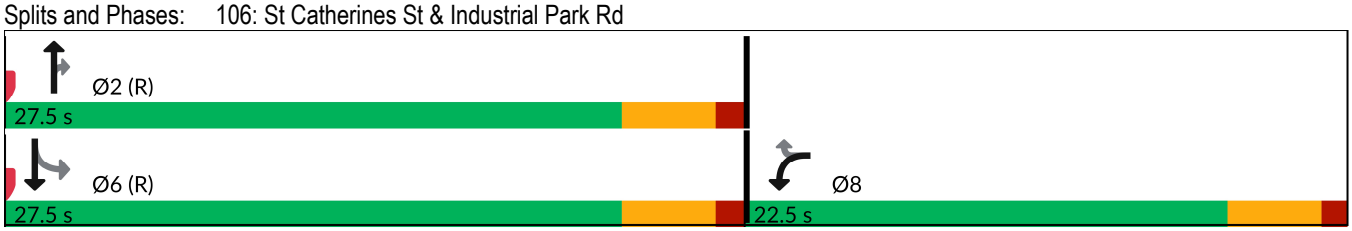
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	251	383	57	20
Volume Left	3	7	36	10
Volume Right	12	3	21	10
cSH	1182	1318	467	474
Volume to Capacity	0.00	0.01	0.12	0.04
Queue Length 95th (m)	0.1	0.1	3.1	1.0
Control Delay (s/veh)	0.1	0.2	13.8	12.9
Lane LOS	A	A	B	B
Approach Delay (s/veh)	0.1	0.2	13.8	12.9
Approach LOS			B	B

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	32.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	102	113	435	278	90	231
Future Volume (vph)	102	113	435	278	90	231
Satd. Flow (prot)	1659	1396	1715	1484	1706	1746
Flt Permitted	0.950				0.383	
Satd. Flow (perm)	1659	1396	1715	1484	688	1746
Satd. Flow (RTOR)		123		302		
Adj. Flow (vph)	111	123	473	302	98	251
Lane Group Flow (vph)	111	123	473	302	98	251
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	22.5	22.5	27.5	27.5	27.5	27.5
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.0	18.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.36	0.36	0.46	0.46	0.46	0.46
v/c Ratio	0.19	0.21	0.60	0.36	0.31	0.31
Control Delay (s/veh)	12.1	3.9	14.1	2.7	11.9	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	12.1	3.9	14.1	2.7	11.9	9.9
LOS	B	A	B	A	B	A
Approach Delay (s/veh)	7.8		9.6			10.5
Approach LOS	A		A			B
Queue Length 50th (m)	6.5	0.0	28.9	0.0	5.1	13.0
Queue Length 95th (m)	14.8	7.7	52.3	9.6	13.6	24.9
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	597	581	788	845	316	803
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.21	0.60	0.36	0.31	0.31

Intersection Summary	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay (s/veh): 9.5	Intersection LOS: A
Intersection Capacity Utilization 44.8%	ICU Level of Service A
Analysis Period (min) 15	

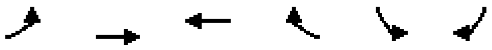
Splits and Phases: 106: St Catherines St & Industrial Park Rd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	268	45	250	233	27	174
Future Volume (Veh/h)	268	45	250	233	27	174
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	291	49	272	253	29	189
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			340		1113	316
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			340		1113	316
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			77		83	73
cM capacity (veh/h)			1160		171	711

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	340	525	218
Volume Left	0	272	29
Volume Right	49	0	189
cSH	1700	1160	501
Volume to Capacity	0.20	0.23	0.44
Queue Length 95th (m)	0.0	6.9	16.5
Control Delay (s/veh)	0.0	5.9	17.6
Lane LOS		A	C
Approach Delay (s/veh)	0.0	5.9	17.6
Approach LOS			C

Intersection Summary			
Average Delay		6.4	
Intersection Capacity Utilization		65.2%	ICU Level of Service C
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	190	242	215	115	178	257
Future Volume (vph)	190	242	215	115	178	257
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	207	263	234	125	193	279

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	470	359	472
Volume Left (vph)	207	0	193
Volume Right (vph)	0	125	279
Hadj (s)	0.32	-0.04	-0.21
Departure Headway (s)	6.6	6.5	6.2
Degree Utilization, x	0.86	0.64	0.81
Capacity (veh/h)	533	529	564
Control Delay (s/veh)	37.5	20.4	30.8
Approach Delay (s/veh)	37.5	20.4	30.8
Approach LOS	E	C	D

Intersection Summary			
Delay	30.3		
Level of Service	D		
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	28.1
Intersection LOS	D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	190	242	215	115	178	257
Future Vol, veh/h	190	242	215	115	178	257
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	6	20	10	9	0	6
Mvmt Flow	207	263	234	125	193	279
Number of Lanes	0	1	1	0	1	0

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	1	1
HCM Control Delay, s/veh	33.4	19.9	29.1
HCM LOS	D	C	D

Lane	EBLn1	WBLn1	SBLn1
Vol Left, %	44%	0%	41%
Vol Thru, %	56%	65%	0%
Vol Right, %	0%	35%	59%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	432	330	435
LT Vol	190	0	178
Through Vol	242	215	0
RT Vol	0	115	257
Lane Flow Rate	470	359	473
Geometry Grp	1	1	1
Degree of Util (X)	0.831	0.634	0.799
Departure Headway (Hd)	6.368	6.36	6.08
Convergence, Y/N	Yes	Yes	Yes
Cap	568	567	596
Service Time	4.414	4.411	4.122
HCM Lane V/C Ratio	0.827	0.633	0.794
HCM Control Delay, s/veh	33.4	19.9	29.1
HCM Lane LOS	D	C	D
HCM 95th-tile Q	8.6	4.4	7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	304	63	61	350	4	54	0	33	2	0	0
Future Volume (vph)	1	304	63	61	350	4	54	0	33	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	330	68	66	380	4	59	0	36	2	0	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	399	450	95	2
Volume Left (vph)	1	66	59	2
Volume Right (vph)	68	4	36	0
Hadj (s)	0.13	0.19	-0.02	0.20
Departure Headway (s)	4.9	4.9	5.9	6.4
Degree Utilization, x	0.54	0.61	0.16	0.00
Capacity (veh/h)	720	720	533	467
Control Delay (s/veh)	13.5	15.3	10.0	9.4
Approach Delay (s/veh)	13.5	15.3	10.0	9.4
Approach LOS	B	C	A	A

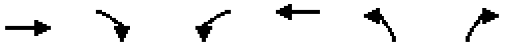
Intersection Summary				
Delay	14.0			
Level of Service	B			
Intersection Capacity Utilization	56.4%	ICU Level of Service	B	
Analysis Period (min)	15			

Intersection	
Intersection Delay, s/veh	15.5
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	304	63	61	350	4	54	0	33	2	0	0
Future Vol, veh/h	1	304	63	61	350	4	54	0	33	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	50	15	6	11	10	0	8	0	0	0	100	0
Mvmt Flow	1	330	68	66	380	4	59	0	36	2	0	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	16.6	15.6	10.2	9.5
HCM LOS	C	C	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	62%	0%	15%	100%
Vol Thru, %	0%	83%	84%	0%
Vol Right, %	38%	17%	1%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	87	368	415	2
LT Vol	54	1	61	2
Through Vol	0	304	350	0
RT Vol	33	63	4	0
Lane Flow Rate	95	400	451	2
Geometry Grp	1	1	1	1
Degree of Util (X)	0.16	0.605	0.615	0.004
Departure Headway (Hd)	6.075	5.449	4.906	6.509
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	594	656	731	553
Service Time	4.075	3.532	2.981	4.514
HCM Lane V/C Ratio	0.16	0.61	0.617	0.004
HCM Control Delay, s/veh	10.2	16.6	15.6	9.5
HCM Lane LOS	B	C	C	A
HCM 95th-tile Q	0.6	4.1	4.3	0



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	311	10	63	404	18	30
Future Volume (Veh/h)	311	10	63	404	18	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	338	11	68	439	20	33
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			349		919	344
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			349		919	344
tC, single (s)			4.2		6.7	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.8	3.3
p0 queue free %			94		92	95
cM capacity (veh/h)			1151		250	695

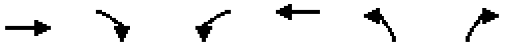
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	349	507	53
Volume Left	0	68	20
Volume Right	11	0	33
cSH	1700	1151	416
Volume to Capacity	0.21	0.06	0.13
Queue Length 95th (m)	0.0	1.4	3.3
Control Delay (s/veh)	0.0	1.7	14.9
Lane LOS		A	B
Approach Delay (s/veh)	0.0	1.7	14.9
Approach LOS			B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	336	198	347	200	151	519
Future Volume (Veh/h)	336	198	347	200	151	519
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	365	215	377	217	164	564
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1269	377			594	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1269	377			594	
tC, single (s)	6.5	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.3	
p0 queue free %	0	66			83	
cM capacity (veh/h)	148	638			958	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	365	215	377	217	164	564
Volume Left	365	0	0	0	164	0
Volume Right	0	215	0	217	0	0
cSH	148	638	1700	1700	958	1700
Volume to Capacity	2.46	0.34	0.22	0.13	0.17	0.33
Queue Length 95th (m)	239.1	11.3	0.0	0.0	4.7	0.0
Control Delay (s/veh)	726.4	13.5	0.0	0.0	9.5	0.0
Lane LOS	F	B			A	
Approach Delay (s/veh)	462.1		0.0		2.1	
Approach LOS	F					

Intersection Summary			
Average Delay	141.7		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	334	70	44	293	42	27
Future Volume (Veh/h)	334	70	44	293	42	27
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	363	76	48	318	46	29
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			439		815	401
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			439		815	401
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		86	96
cM capacity (veh/h)			1121		332	649

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	439	366	75
Volume Left	0	48	46
Volume Right	76	0	29
cSH	1700	1121	409
Volume to Capacity	0.26	0.04	0.18
Queue Length 95th (m)	0.0	1.0	5.0
Control Delay (s/veh)	0.0	1.5	15.8
Lane LOS		A	C
Approach Delay (s/veh)	0.0	1.5	15.8
Approach LOS			C

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	306	37	76	300	29	23	0	46	17	0	17
Future Volume (Veh/h)	29	306	37	76	300	29	23	0	46	17	0	17
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	333	40	83	326	32	25	0	50	18	0	18
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	358			373			943	941	353	975	945	342
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	358			373			943	941	353	975	945	342
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			93			89	100	93	91	100	97
cM capacity (veh/h)	1201			1185			219	238	691	199	237	701

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	405	441	75	36
Volume Left	32	83	25	18
Volume Right	40	32	50	18
cSH	1201	1185	402	309
Volume to Capacity	0.03	0.07	0.19	0.12
Queue Length 95th (m)	0.6	1.7	5.1	3.0
Control Delay (s/veh)	0.9	2.2	16.0	18.2
Lane LOS	A	A	C	C
Approach Delay (s/veh)	0.9	2.2	16.0	18.2
Approach LOS			C	C

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	51.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	33	168	6	53	242
Future Volume (Veh/h)	4	33	168	6	53	242
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	36	183	7	58	263
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	566	187			190	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	566	187			190	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			96	
cM capacity (veh/h)	466	856			1384	

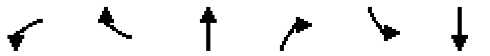
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	40	190	321
Volume Left	4	0	58
Volume Right	36	7	0
cSH	789	1700	1384
Volume to Capacity	0.05	0.11	0.04
Queue Length 95th (m)	1.2	0.0	1.0
Control Delay (s/veh)	9.8	0.0	1.7
Lane LOS	A		A
Approach Delay (s/veh)	9.8	0.0	1.7
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	33	140	6	53	193
Future Volume (Veh/h)	4	33	140	6	53	193
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	36	152	7	58	210
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	482	156			159	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	482	156			159	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			96	
cM capacity (veh/h)	521	890			1420	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	40	159	268
Volume Left	4	0	58
Volume Right	36	7	0
cSH	831	1700	1420
Volume to Capacity	0.05	0.09	0.04
Queue Length 95th (m)	1.2	0.0	1.0
Control Delay (s/veh)	9.5	0.0	1.9
Lane LOS	A		A
Approach Delay (s/veh)	9.5	0.0	1.9
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	33	113	3	53	142
Future Volume (Veh/h)	2	33	113	3	53	142
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	36	123	3	58	154
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	395	125			126	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	395	125			126	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			96	
cM capacity (veh/h)	586	926			1460	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	38	126	212
Volume Left	2	0	58
Volume Right	36	3	0
cSH	899	1700	1460
Volume to Capacity	0.04	0.07	0.04
Queue Length 95th (m)	1.0	0.0	0.9
Control Delay (s/veh)	9.2	0.0	2.3
Lane LOS	A		A
Approach Delay (s/veh)	9.2	0.0	2.3
Approach LOS	A		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	27.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	365	35	21	284	29	21	0	13	17	0	17
Future Volume (Veh/h)	29	365	35	21	284	29	21	0	13	17	0	17
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	397	38	23	309	32	23	0	14	18	0	18
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	341			435			869	867	416	865	870	325
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	341			435			869	867	416	865	870	325
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			98			91	100	98	93	100	97
cM capacity (veh/h)	1218			1125			256	277	637	259	276	716

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	467	364	37	36
Volume Left	32	23	23	18
Volume Right	38	32	14	18
cSH	1218	1125	331	380
Volume to Capacity	0.03	0.02	0.11	0.09
Queue Length 95th (m)	0.6	0.5	2.8	2.4
Control Delay (s/veh)	0.8	0.7	17.2	15.5
Lane LOS	A	A	C	C
Approach Delay (s/veh)	0.8	0.7	17.2	15.5
Approach LOS			C	C

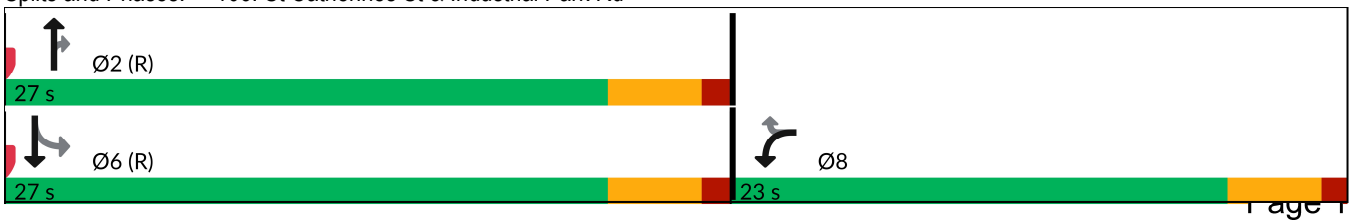
Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	40.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	336	198	347	200	151	519
Future Volume (vph)	336	198	347	200	151	519
Satd. Flow (prot)	1659	1396	1715	1484	1706	1746
Flt Permitted	0.950				0.471	
Satd. Flow (perm)	1659	1396	1715	1484	846	1746
Satd. Flow (RTOR)		215		217		
Adj. Flow (vph)	365	215	377	217	164	564
Lane Group Flow (vph)	365	215	377	217	164	564
Turn Type	Prot	Perm	NA	Perm	Perm	NA
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	23.0	23.0	27.0	27.0	27.0	27.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Act Effct Green (s)	18.5	18.5	22.5	22.5	22.5	22.5
Actuated g/C Ratio	0.37	0.37	0.45	0.45	0.45	0.45
v/c Ratio	0.60	0.33	0.49	0.28	0.43	0.72
Control Delay (s/veh)	17.6	3.7	12.4	2.6	13.9	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.6	3.7	12.4	2.6	13.9	18.0
LOS	B	A	B	A	B	B
Approach Delay (s/veh)	12.5		8.8			17.1
Approach LOS	B		A			B
Queue Length 50th (m)	25.2	0.0	21.9	0.0	9.3	37.9
Queue Length 95th (m)	46.7	10.0	40.1	8.4	22.2	#71.5
Internal Link Dist (m)	199.1		398.4			245.1
Turn Bay Length (m)	60.0			55.0	100.0	
Base Capacity (vph)	613	651	771	787	380	785
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.33	0.49	0.28	0.43	0.72

Intersection Summary	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Control Type: Pretimed	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay (s/veh): 13.1	Intersection LOS: B
Intersection Capacity Utilization 56.5%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 106: St Catherines St & Industrial Park Rd



APPENDIX J

Arcady Outputs – Future Total Conditions (2030)

Junctions 11

ARCADY 11 - Roundabout Module

Filename: Townline Rd_&_RR20_Future Total.j11
Path: C:\Users\akamal\OneDrive - Stantec\Desktop\Projects\Smithville
Report generation date: 7/28/2025 2:32:29 PM

»Future Total | 2030 | AM
»Future Total | 2030 | PM

Summary of intersection performance

	AM							PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	Future Total - 2030													
1 - Access Road		2.2	12.26	0.44	B	10.04	B		1.0	8.30	0.25	A	20.24	C
2 - St. Catharines Street		1.5	7.12	0.34	A				13.2	28.79	0.90	D		
3 - Townline Road W		2.5	9.69	0.47	A				3.4	14.31	0.55	B		
4 - Regional Road 20		3.4	11.21	0.55	B				4.6	13.64	0.63	B		

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

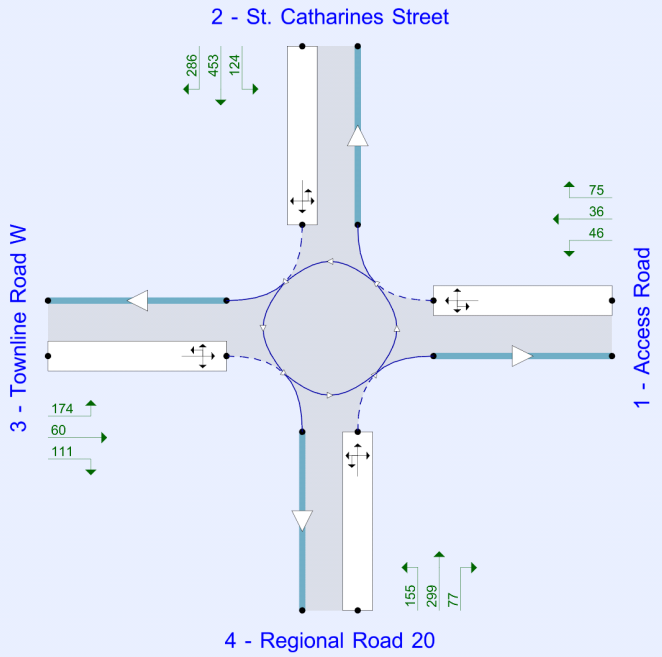
File summary

File Description

Title	Future Total (2030)
Location	
Site number	
Date	7/25/2025
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	CORP\akamal
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	Veh	Veh	perHour	s	-Min	perMin



Flows show original traffic demand (Veh/hr)

The intersection diagram reflects the last run of Intersections.

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	V/C Ratio Threshold	Average Delay threshold (s)	Queue threshold (PCE)
✓		0.85	36.00	20.00

HCM Calibration

HCM Calibration	Lane type	Num circulating lanes	Num exit lanes	A	B
1	Single lane	1		1380.00	-0.00102
2	Single lane	2		1420.00	-0.00085
3	Nearside	1		1420.00	-0.00091
4	Nearside	2		1420.00	-0.00085
5	Offside	1		1420.00	-0.00091
6	Offside	2		1350.00	-0.00092
7	Yielding bypass		1	1380.00	-0.00102
8	Yielding bypass		2	1420.00	-0.00085
9	Non-yielding bypass		1	99999.00	0.00000

Demand Set Summary

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Future Total	2030	AM	PHF	08:00	09:00	15
D2	Future Total	2030	PM	PHF	17:00	18:00	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

Future Total | 2030 | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D1 - Future Total | 2030 | AM	Demand Set 1: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3, 4	10.04	B

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Left	Normal/unknown	10.04	B

Legs

Legs

Leg	Name	Description
1	Access Road	
2	St. Catharines Street	
3	Townline Road W	
4	Regional Road 20	

HCM Lanes

Leg	HCM Lane	Lane type	Number of conflicting lanes	Destination legs
1 - Access Road	1	Single lane	1	1, 2, 3, 4
2 - St. Catharines Street	1	Single lane	1	1, 2, 3, 4
3 - Townline Road W	1	Single lane	1	1, 2, 3, 4
4 - Regional Road 20	1	Single lane	1	1, 2, 3, 4

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	Future Total	2030	AM	PHF	08:00	09:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - Access Road		✓	252	100.000
2 - St. Catharines Street		✓	319	100.000
3 - Townline Road W		✓	394	100.000
4 - Regional Road 20		✓	473	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - Access Road	252	0.92	SecondQuarter
2 - St. Catharines Street	319	0.92	SecondQuarter
3 - Townline Road W	394	0.92	SecondQuarter
4 - Regional Road 20	473	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	113	58	81
	2 - St. Catharines Street	38	0	83	198
	3 - Townline Road W	19	210	0	165
	4 - Regional Road 20	27	390	56	0

Vehicle Mix

Heavy Vehicle %

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	0	0	0
	2 - St. Catharines Street	0	0	13	8
	3 - Townline Road W	0	8	0	0
	4 - Regional Road 20	0	6	24	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - Access Road	0.44	12.26	2.2	B
2 - St. Catharines Street	0.34	7.12	1.5	A
3 - Townline Road W	0.47	9.69	2.5	A
4 - Regional Road 20	0.55	11.21	3.4	B

Main Results for each time segment

08:00 - 08:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	237	618	0.00	698	0.340	237	1.5	9.496	A
2 - St. Catharines Street	301	184	0.00	1043	0.288	301	1.2	6.287	A
3 - Townline Road W	371	299	0.00	961	0.386	371	1.8	8.011	A
4 - Regional Road 20	446	252	0.00	975	0.457	446	2.4	9.051	A

08:15 - 08:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	274	713	0.00	628	0.436	274	2.2	12.263	B
2 - St. Catharines Street	347	212	0.00	1011	0.343	347	1.5	7.124	A
3 - Townline Road W	428	345	0.00	915	0.468	428	2.5	9.685	A
4 - Regional Road 20	514	290	0.00	935	0.550	514	3.4	11.206	B

08:30 - 08:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	259	675	0.00	655	0.396	259	1.9	11.024	B
2 - St. Catharines Street	328	201	0.00	1023	0.321	328	1.4	6.773	A
3 - Townline Road W	405	326	0.00	933	0.434	405	2.2	8.958	A
4 - Regional Road 20	487	275	0.00	950	0.512	487	3.0	10.253	B

08:45 - 09:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	237	618	0.00	698	0.340	237	1.5	9.496	A
2 - St. Catharines Street	301	184	0.00	1043	0.288	301	1.2	6.287	A
3 - Townline Road W	371	299	0.00	961	0.386	371	1.8	8.011	A
4 - Regional Road 20	446	252	0.00	975	0.457	446	2.4	9.051	A

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 08:00-08:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	237	237	0.00	618	698	1.51	9.50	0.34	A
2 - St. Catharines Street	1	1, 2, 3, 4	301	301	0.00	184	1043	1.20	6.29	0.29	A
3 - Townline Road W	1	1, 2, 3, 4	371	371	0.00	299	961	1.84	8.01	0.39	A
4 - Regional Road 20	1	1, 2, 3, 4	446	446	0.00	252	975	2.44	9.05	0.46	A

Lane Results: 08:15-08:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	274	274	0.00	713	628	2.21	12.26	0.44	B
2 - St. Catharines Street	1	1, 2, 3, 4	347	347	0.00	212	1011	1.54	7.12	0.34	A
3 - Townline Road W	1	1, 2, 3, 4	428	428	0.00	345	915	2.53	9.69	0.47	A
4 - Regional Road 20	1	1, 2, 3, 4	514	514	0.00	290	935	3.44	11.21	0.55	B

Lane Results: 08:30-08:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	259	259	0.00	675	655	1.89	11.02	0.40	B
2 - St. Catharines Street	1	1, 2, 3, 4	328	328	0.00	201	1023	1.39	6.77	0.32	A
3 - Townline Road W	1	1, 2, 3, 4	405	405	0.00	326	933	2.23	8.96	0.43	A
4 - Regional Road 20	1	1, 2, 3, 4	487	487	0.00	275	950	2.99	10.25	0.51	B

Lane Results: 08:45-09:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	**1**	1, 2, 3, 4	237	237	0.00	618	698	1.51	9.50	0.34	A
2 - St. Catharines Street	**1**	1, 2, 3, 4	301	301	0.00	184	1043	1.20	6.29	0.29	A
3 - Townline Road W	**1**	1, 2, 3, 4	371	371	0.00	299	961	1.84	8.01	0.39	A
4 - Regional Road 20	**1**	1, 2, 3, 4	446	446	0.00	252	975	2.44	9.05	0.46	A

Future Total | 2030 | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	HCM Model	D2 - Future Total | 2030 | PM	Demand Set 2: HCM models are most typically used with PHF traffic flow profiles and single time segments. Use of HCM models with other flow profiles is at the user's own risk
Warning	HCM Model		One or more intersections use HCM methodologies. These methods are not associated with TRL. The user should apply judgement when interpreting the results.
Last Run	Last Run	2 - St. Catharines Street - HCM Lane 1	HCM model: Leg 2, Lane 1: V/C Ratio is above 0.85 for one or more time segments.HCM results may be unreliable. Consider using HCM simulation mode. See User Guide For more details.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Intersection Network

Intersections

Intersection	Name	Intersection type	Use circulating lanes	Leg order	Intersection Delay (s)	Intersection LOS
1	Townline Rd W & Regional Rd 20	HCM Roundabout		1, 2, 3, 4	20.24	C

Intersection Network

Driving side	Lighting	Network delay (s)	Network LOS
Left	Normal/unknown	20.24	C

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	Future Total	2030	PM	PHF	17:00	18:00	15

Demand overview (Traffic)

Leg	Linked leg	Use O-D data	Average Demand (Veh/hr)	Scaling Factor (%)
1 - Access Road		✓	157	100.000
2 - St. Catharines Street		✓	863	100.000
3 - Townline Road W		✓	345	100.000
4 - Regional Road 20		✓	531	100.000

Peak Hour Factor Data (Traffic)

Leg	Hourly volume (Veh/hr)	Peak hour factor	Peak time segment
1 - Access Road	157	0.92	SecondQuarter
2 - St. Catharines Street	863	0.92	SecondQuarter
3 - Townline Road W	345	0.92	SecondQuarter
4 - Regional Road 20	531	0.92	SecondQuarter

Origin-Destination Data

Demand (Veh/hr)

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	75	36	46
	2 - St. Catharines Street	124	0	286	453
	3 - Townline Road W	60	174	0	111
	4 - Regional Road 20	77	299	155	0

Vehicle Mix

Heavy Vehicle %

		To			
		1 - Access Road	2 - St. Catharines Street	3 - Townline Road W	4 - Regional Road 20
From	1 - Access Road	0	0	0	0
	2 - St. Catharines Street	0	0	0	3
	3 - Townline Road W	0	0	0	0
	4 - Regional Road 20	0	3	0	0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max 95th percentile Queue (Veh)	Max LOS
1 - Access Road	0.25	8.30	1.0	A
2 - St. Catharines Street	0.90	28.79	13.2	D
3 - Townline Road W	0.55	14.31	3.4	B
4 - Regional Road 20	0.63	13.64	4.6	B

Main Results for each time segment

17:00 - 17:15

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	148	592	0.00	748	0.198	148	0.7	6.980	A
2 - St. Catharines Street	813	223	0.00	1082	0.751	813	7.4	16.372	C
3 - Townline Road W	325	587	0.00	749	0.434	325	2.2	10.618	B
4 - Regional Road 20	500	337	0.00	962	0.520	500	3.1	10.321	B

17:15 - 17:30

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	171	683	0.00	681	0.251	171	1.0	8.297	A
2 - St. Catharines Street	938	258	0.00	1045	0.898	938	13.2	28.787	D
3 - Townline Road W	375	677	0.00	681	0.550	375	3.4	14.309	B
4 - Regional Road 20	577	389	0.00	912	0.633	577	4.6	13.641	B

17:30 - 17:45

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	162	646	0.00	707	0.228	162	0.9	7.734	A
2 - St. Catharines Street	888	244	0.00	1059	0.838	888	10.4	22.245	C
3 - Townline Road W	355	641	0.00	707	0.502	355	2.8	12.610	B
4 - Regional Road 20	546	368	0.00	932	0.586	546	3.9	12.115	B

17:45 - 18:00

Leg	Total Demand (Veh/hr)	Circulating flow (Veh/hr)	Pedestrian demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	Throughput (Veh/hr)	Queue95 (Veh)	Delay (s)	Unsignalised level of service
1 - Access Road	148	592	0.00	748	0.198	148	0.7	6.980	A
2 - St. Catharines Street	813	223	0.00	1082	0.751	813	7.4	16.372	C
3 - Townline Road W	325	587	0.00	749	0.434	325	2.2	10.618	B
4 - Regional Road 20	500	337	0.00	962	0.520	500	3.1	10.321	B

Queue Variation Results for each time segment

HCM: Lane Results

Lane Results: 17:00-17:15

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	148	148	0.00	592	748	0.73	6.98	0.20	A
2 - St. Catharines Street	1	1, 2, 3, 4	813	813	0.00	223	1082	7.43	16.37	0.75	C
3 - Townline Road W	1	1, 2, 3, 4	325	325	0.00	587	749	2.21	10.62	0.43	B
4 - Regional Road 20	1	1, 2, 3, 4	500	500	0.00	337	962	3.08	10.32	0.52	B

Lane Results: 17:15-17:30

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	171	171	0.00	683	681	0.99	8.30	0.25	A
2 - St. Catharines Street	1	1, 2, 3, 4	938	938	0.00	258	1045	13.24	28.79	0.90	D
3 - Townline Road W	1	1, 2, 3, 4	375	375	0.00	677	681	3.37	14.31	0.55	B
4 - Regional Road 20	1	1, 2, 3, 4	577	577	0.00	389	912	4.65	13.64	0.63	B

Lane Results: 17:30-17:45

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	162	162	0.00	646	707	0.88	7.73	0.23	A
2 - St. Catharines Street	1	1, 2, 3, 4	888	888	0.00	244	1059	10.45	22.24	0.84	C
3 - Townline Road W	1	1, 2, 3, 4	355	355	0.00	641	707	2.84	12.61	0.50	B
4 - Regional Road 20	1	1, 2, 3, 4	546	546	0.00	368	932	3.93	12.11	0.59	B

Lane Results: 17:45-18:00

Leg	HCM Lane	Destination legs	Demand (Veh/hr)	Throughput (Veh/hr)	Pedestrian flow (Ped/hr)	Conflicting flow (Veh/hr)	Capacity (Veh/hr)	Queue95 (Veh)	Delay (s)	V/C Ratio	LOS
1 - Access Road	1	1, 2, 3, 4	148	148	0.00	592	748	0.73	6.98	0.20	A
2 - St. Catharines Street	1	1, 2, 3, 4	813	813	0.00	223	1082	7.43	16.37	0.75	C
3 - Townline Road W	1	1, 2, 3, 4	325	325	0.00	587	749	2.21	10.62	0.43	B
4 - Regional Road 20	1	1, 2, 3, 4	500	500	0.00	337	962	3.08	10.32	0.52	B

APPENDIX K

Traffic Signal Warrant – Future Total Conditions (2030)

Intersection:	Industrial Park Rd @ Regional Road 20		
Major Street:	North-South	Lanes:	1
Minor Street:	East-West	Lanes:	1
Urban/Rural:	Urban		
Legs:	3		
New/Existing Intersection:	existing		
Scenario:	2030 Ultimate		

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AmPHV	0	435	278	90	231	0	0	0	0	102	0	113
PmPHV	0	347	200	151	519	0	0	0	0	336	0	198
AHV	0	196	120	60	188	0	0	0	0	110	0	78

Justification #7

Justification	Description	Minimum Requirement 1 Lane Highway		Minimum Requirement 2 or More Lanes		Compliance Sectional		Compliance Entire %	Signal
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	844	117%	117%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	281	165%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	600	900	563	134%	134%	Yes
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	120	170	110	146%		

Notes:

1. Refer to OTM Book 12, pg 92, March 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PHV/2 or (AM + PM) / 4

APPENDIX L

Comment Response Matrix on TIS Submission (August 2024) – Niagara Region

No.	Date Provided	Comment Source	Review Comment	Stantec Response
1	10/31/2024	Niagara Region	General comment - check that all turning movements are correctly labelled. For example, Section 8.0 Conclusions & Recommensations makes reference to a "Westbound left-turn movement" at the St Catharines Street and Industrial Park Road intersection, which does not exist at this three-legged intersection	Noted. The report has been updated to label Industrial Park Road as a north-south roadway in the updated submission.
2	10/31/2024	Niagara Region	Figure 4.11 and Figure 4.12 (Block Plan Area 9, without Phase 1 Site-generated Volume - AM Peak Hour & PM Peak Hour): The figures appear to show lower trip volumes than those calculated in Table 4.1, which will underestimate the capacity analysis results in the subsequent scenarios. Please revise figures to reflec the total trips generated from block Area 9 without phase 1 as calculated in Table 4.1	Noted. Trip volumes revised in updated submission.
3	10/31/2024	Niagara Region	Figure 5.1 (Existing Conditions Scenario (2024) - Weekday AM Peak Hour Traffic Volumes: The traffic volumes shown at intersections of Townlines Road with Port Davidson Road and Canborough Street are lower than the TMCs volumes in Appendix A. Please revise and edit volumes accordingly as this will underestimate the assessment results in the subsequent AM peak hour scenarios	Noted. Traffic volumes in the Weekday AM Peak Hour for the Existing Conditions were revised to align with TMC volumes, and the associated capacity analyses were revised accordingly. Traffic volumes and the associated capacity analyses under Future Background and Future Total conditions were subseqeuently updated to reflect the Existing Conditions volume revision.
4	10/31/2024	Niagara Region	Section 5.2 Existing Conditions Scenario (2024): The TIS states, "the traffic count data at the five intersections were collected on June 13th, 2024, with the exception of Townline Road and St. Catharines Street, which was collected on June 15th, 2023." This should be revised to indicate the traffic count for the St. Catharines Street and Industrial Park Road was also collected on June 15th, 2023. Please refer to the TMCs attached in Appendix A.	Noted. The text in Section 5.2 has been modified as follows: "The traffic count data at the Townline Road and Industrial Park Road was collected in 2023, while the traffic count data collected at other study area intersections were collected in 2024."
5	10/31/2024	Niagara Region	Section 5.3 Future Background Scenario (2030): It is noted that traffic volumes used in the capacity analysis (attached in Appendix E) for Future Background Scenario (2030) - PM peak hour are lower than the volumes calculated in Figure 5.5: Future Background Scenario (2030)- Weekday PM Peak Hour Traffic Volumes. Please revise the capacity analysis, synchro reports, and results shown in Table 5.4 accordingly with the corrected volumes.	Noted. Traffic volumes revised in updated submission.
6	10/31/2024	Niagara Region	As a general comment, the Region will monitor conditions to determine when various improvements (e.g. recommended signalization of St. Catharines Street and Industrial Park Road) are warranted. The Region notes that traffic patterns in the area could change following the potential future construction of a Downtown Smithville Bypass Route. Future improvements to Regional and municipal roads were also contemplated through the Smithville Master Community Plan and Smithville Transportation Master Plan recently prepared by the Township.	Noted.